This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

KF
24114
HN 4NND H

ROCKS
OF
CAPE COLVILLE PENINSULA, N.Z.
BY
PROF. SOLLAS, F.R.S.
WITH
INTRODUCTION & DESCRIPTIVE NOTES
BY
ALEXANDER McKAY, F.G.S.

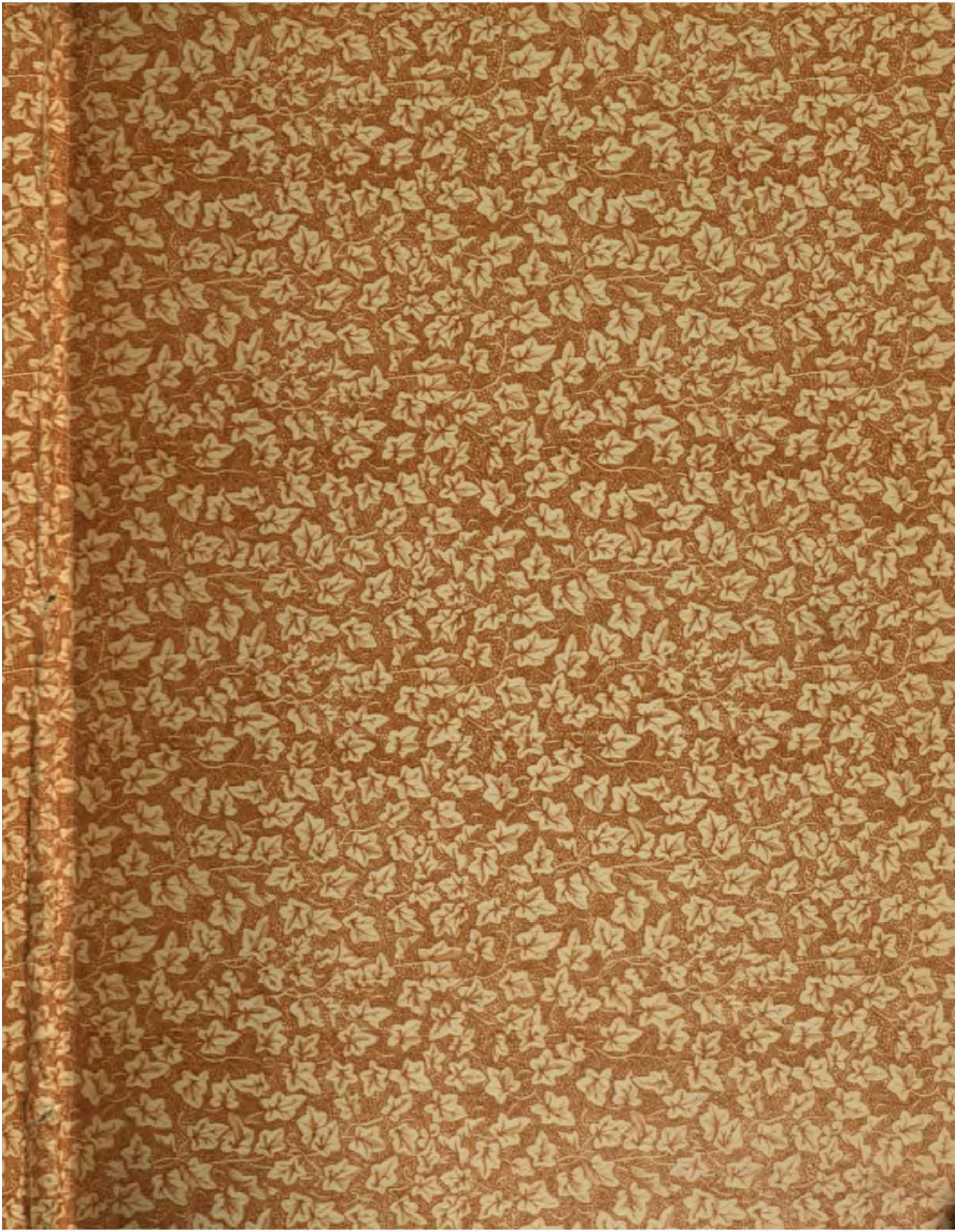
VOL. II.

KF 24114 (2)

Harvard College Library

FROM

The Minister of Mines.



THE

ROCKS OF CAPE COLVILLE PENINSULA,

AUCKLAND, NEW ZEALAND.

BY

PROFESSOR SOLLAS, F.R.S.;

WITH AN

INTRODUCTION AND DESCRIPTIVE NOTES

BY

ALEXANDER McKAY, F.G.S.,

Government Geologist, N.Z.

VOL. II.

WELLINGTON.
BY AUTHORITY: JOHN MACKAY, GOVERNMENT PRINTER.
1906.

Geol 7289.05

KF 24114 (2)

HARVARD COLLEGE LIBRARY
JUN 28 1911
CAMBRIDGE, MASS.

The Ministry of Mines

Mines Department,
Wellington, New Zealand, July, 1906.

THIS, the second volume of "Rocks of Cape Colville Peninsula," completes the descriptions by Professor Sollas and the notes as to place and formation by Alexander McKay.

In addition to the 400 specimens described as rocks of Cape Colville Peninsula, there are contained in Vol. ii descriptions of ninety-two rock-specimens from other districts of New Zealand, including small collections from a number of localities, particularly from conglomerates at Cheviot Hills, Nelson; and from the east shore of Palliser Bay, Wellington; that are of special interest in connection with a comparison of these with conglomerates derived from the older eruptive and intrusive rocks of the northern part of Cape Colville Peninsula.

These additional specimens are described petrographically by Professor Sollas, and the illustrations and notes as to locality, formation, &c., are by Mr. McKay, Geologist of the Mines Department.

JAS. McGOWAN,
Minister of Mines.

PREFATORY NOTE.

THIS second volume of descriptions by Professor Sollas, with notes on the locality and formation of the different specimens by Alexander McKay, contains, besides descriptions of rocks from Cape Colville Peninsula, descriptions of rocks from various parts of New Zealand.

Some of the added descriptions are of great interest by way of comparison with the older igneous rocks of Cape Colville Peninsula, and they therefore rightly appear in this volume.

Other descriptions of rocks from Poverty Bay, Auckland, New Plymouth, Taranaki, the Kaimanawa Mountains, and the east and west coasts of the Wellington Provincial District, and of a considerable collection from Westland, have no very evident relation to or connection with the rocks of Cape Colville, and have been included admittedly as adventitious matter for the purpose of making Volume II somewhat correspond in size with Volume I, and at the same time publishing descriptions that in themselves are of considerable interest.

ALEXANDER McKAY.

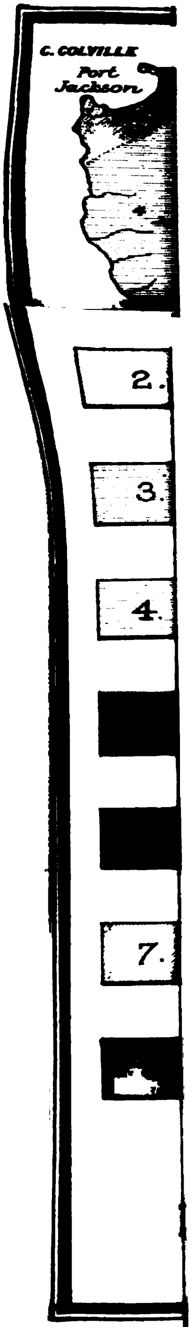
19th March, 1906.

ROCKS OF CAPE COLVILLE PENINSULA.

VOL. II.

CONTENTS.

	Page
Prefatory note	iii
Descriptions of rocks of Cape Colville Peninsula	1–147
Description of rock-specimen from various parts of New Zealand, in continuation of "Rocks of Cape Colville Peninsula"	149–202
List of rocks from various parts of New Zealand	149–153
Description of specimens from the east coast of Wellington Provincial District	153–157
Description of fuchsite schist from Lake County, Otago	158
Description of basalt from Wade, Auckland	158
Description of granite from Cape Foulwind, Nelson	159
Description of hornblende andesite from the west coast of Wellington ..	159–160
Description of vesicular basalt from the Waipara River, Canterbury ..	160–161
Description of andesites from Sugar Loaves, Taranaki	161–162
Description of various rocks from the Kaimanawa Mountains, Wellington Provincial District..	163–166
Description of granite from Preservation Inlet, Otago	166–167
Description of basalts from the Amuri district of Nelson	167–169
Description of various rocks from a conglomerate in the Coast Range, Cheviot Hills, Nelson	169–173
Description of various rocks from a conglomerate in the Waipaoa Valley, Poverty Bay, Auckland	174–178
Description of various rocks from the east shore of Palliser Bay, Wellington	178–185
Description of serpentinised pyroxene rock from Dun Mountain mineral belt, Nelson	185–186
Description of various rocks from the district of Westland north of the Hokitika River	186–202


C. COLVILLE
Port Jackson
2.
3.
4.
7.

REPORT

ON

A COLLECTION OF ROCKS FROM CAPE COLVILLE PENINSULA, AUCKLAND, NEW ZEALAND,

BY

WILLIAM JOHNSON SOLLAS, D.Sc., CANTAB.; LL.D., DUBLIN; M.A., OXON.; F.R.S.; F.G.S.:

FELLOW OF UNIVERSITY COLLEGE, OXFORD; AND PROFESSOR OF GEOLOGY
IN THE UNIVERSITY OF OXFORD, ENGLAND.

VOL. II.

DESCRIPTION OF SPECIMENS—*continued.*

No. 205.

By an oversight this specimen was returned without having been sliced and without description.

No. 206/1.

M.C.—Irregularly coarsely banded rhyolite, greenish-white with violet-grey streaks, a flinty appearance, breaking irregularly, with scattered phenocrysts of felspar and quartz.

U.M.—GROUNDMASS almost colourless; looks like a granular glass with developed perlitic cracks. Under high magnification resolved into two constituents, which may be indicated by the letters *H* and *L*; both have a *r.i.* lower than balsam, but that of *H* is above that of *L*. Both are transparent and colourless, but according to a universal rule *H*, owing to its higher refractive index, looks greenish compared to L, which has a pinkish appearance. *L* occurs in minute spherical forms, and nearly equals in volume *H*, which makes up the greater part of the rest of the rock. The globules of *L* may become confluent or form clusters like grapes, *H* remaining between as an irregular arabesque network.

Sometimes L exchanges the globular for a radio-fibrous form, forming tufts which lie immersed in H. L is simply refracting; H possesses double refraction, and extinguishes as a small-grained mosaic with indications of fibrous structure. Since H lies immediately adjacent to the perlitic cracks, it is more likely to be a product of alteration than L. L might be the remains of the original glass and H a hydration product. Of course, L may be an alteration product also. To decide this point a slice was removed from the glass slide by soaking in benzol and treated with fuchsin. Neither constituents were stained. Boiling in strong hydrochloric acid produced no effect; nor after boiling in NaHo, washing and soaking in fuchsin, was any staining effected. For the present, therefore, we must regard the two constituents as undetermined, and can speak only of an altered glass as forming the groundmass.

PHENOCRYSTS.—*Plagioclase* in single crystals and clusters; sometimes much fractured *in situ*, so as to form a microscopic breccia, the interstices filled with the matrix; sometimes filled by finely granular isotropic material. Zonal; *r.i.*, above balsam; ext., 12°/15°, 30°/30° (labradorite).

Pyroxene, represented entirely by pseudomorphs of generally isotropic fine granular material, white by reflected light, brown by transmitted light, with *r.i.* below balsam; in places a fibrous substance is also present, and this is doubly refracting. In one case a core of biotite was observed within one of these pseudomorphs. Crystals of apatite are frequently included. Some very elongated pseudomorphs pyroxene (probably hypersthene) broken across—it may be into as many as four pieces—and floated slightly apart from one another before final consolidation of the rock.

Hornblende: Some of the pseudomorphs may possibly have formed after hornblende.

Ilmenite: Some brown grains (white by reflected light) have, I think, resulted from the alteration of this mineral.

Magnetite: A few grains.

Quartz: The slide does not show any quartz, but it is obviously present to the unaided eye in the hand-specimen.

Rhyolite, containing plagioclase and pyroxene; much-altered perlitic glass.

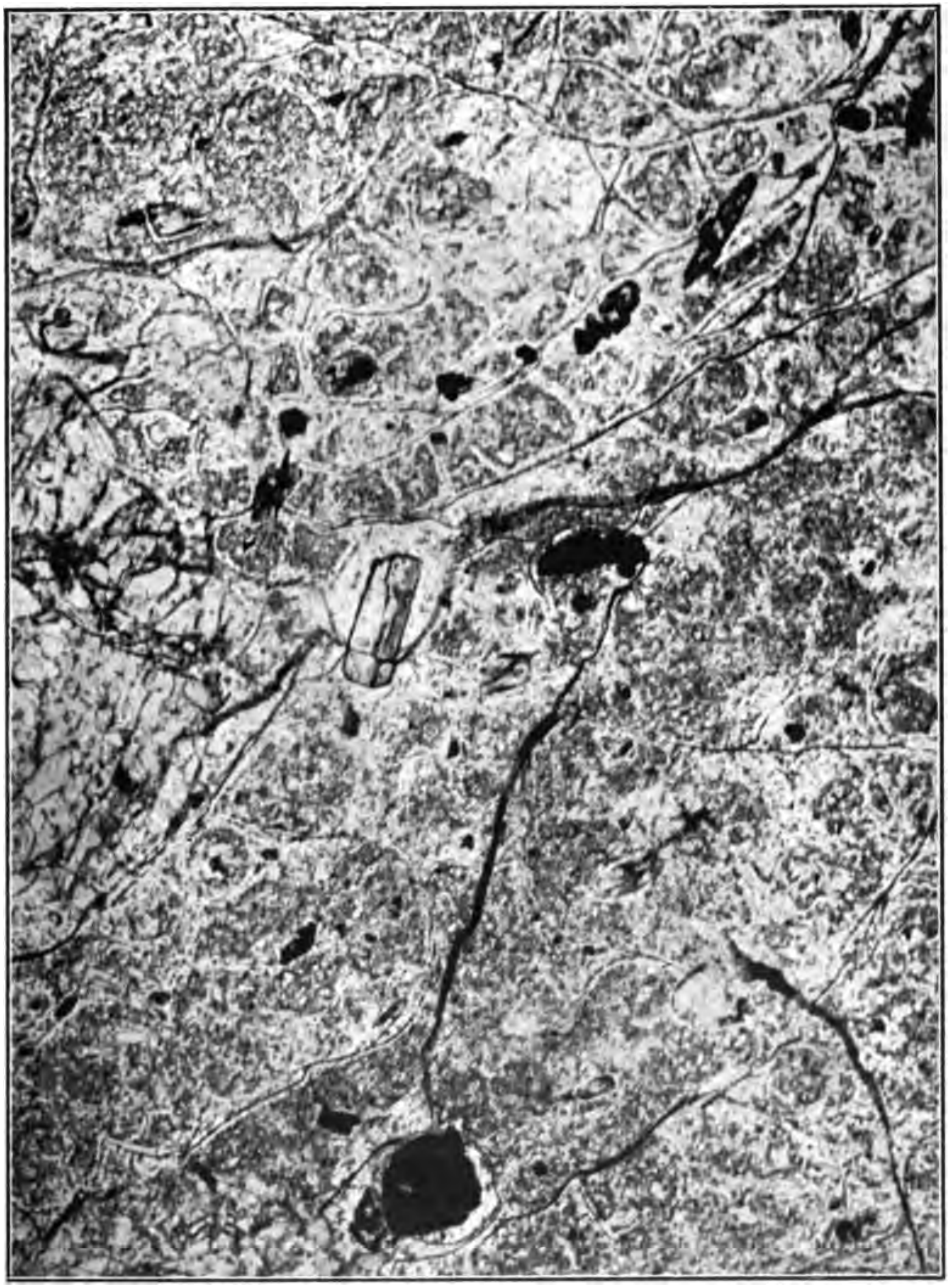
Illustration.—The slice shows but feeble contrasts.

Photographed by ordinary light; magnification, 48 diameters; area photographed, upper middle, which to some extent indicates the general character of the slice, the correct representation of which under the power used would require the taking of quite a number of photographs.

Locality.—Low level on the Ruapehu Claim, Owharoa district, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This rock occurs as undecomposed masses in a soft granular or clayey rock. The masses of hard rock when broken into are frequently cavernous, and the



No. 206/1. RHYOLITE.

[*To face p.* 2, *Vol. II.*

cavities as a rule are incrusted and more or less, but seldom completely, filled with quartz and opaline deposits. When not filled with solid matter the cavities contain water, which, in dressing specimens of the rock, is shed abundantly. This and the associated rock forms a massive development, which from the Waitawheta extends north-north-east by way of Owharoa into the Waitekauri Valley.

No. 207/3.

M.C. — An irregularly and coarsely banded rhyolite; darker compact lustrous layers streaked with lighter porous dull streaks; small but obvious phenocrysts of felspar and ferro-magnesian minerals.

U.M.—Colourless glass with patches of minutely crystalline and spherulitic material, abundant microliths and crystallites, and numerous phenocrysts.

The glass is cracked perlitically, and the margins of the cracks are doubly refracting. No fibrous structure is discernible in the adjacent glass, the doubly refracting layer being of extreme thinness. A singular structure is common in this glass: minute circular areas about 0·02 mm. in diameter, varying a little above and below this, are defined by a sharp line which sometimes broadens into a band of higher *r.i.* than the glass of visible thickness, but too thin to measure. It varies in thickness and definition, and is sometimes continued inwards into ragged radial extensions towards the centre, at or about which globulites, or radial wedges, or some other form of crystallites usually are met with. Frequently the crystallite appears to occupy a precisely central position. The behaviour of these circumscribed areas towards polarised light varies very considerably. In many cases they do not give reaction; in others they do. The marginal band is generally doubly refracting. Rarely an area as much as twice the usual size is encountered, with radio-fibrous structure proceeding from the centre, as though it were an embryo spherulite. It would appear that the globule—for this shape is indicated by the circular periphery—is determined by the central crystallite, and represents a contraction product; the material of this globule is probably richer in those molecules which form the central crystallite than the surrounding glass is, and its surface may represent a minute perlitic fissure. The varying width and form of the superficial layer may be a result of secondary alteration, or possibly of a peripheral deposit of material similar to that which forms the crystalline nucleus. On treatment with dilute hydrofluoric acid the globule is more readily attacked than the surrounding glass, as shown by subsequent staining with fuchsin. When doubly refracting its optic sign is negative. It may be an embryonic negative microspherulite. The more crystalline patches sometimes surround a close accumulation of spherical bodies like the preceding, but without a nucleus, and but for the curved form of the overlapping outlines, recalling the appearance of tridymite, a resemblance all the more confusing when, as sometimes happens, tridymite is actually associated with them. The surrounding material is frequently positive spherulitic fibre, forming tufts or more complete spherulites.

PHENOCRYSTS.—*Plagioclase* with crystalline outlines, but often broken, numerous; albite and other twinning; ext., 20°/ 27°, 22°/ 30° (labradorite); abundant inclusions, sometimes of a vermiculate whorl of positive spherulitic fibres, in one case biotite, magnetite, apatite and glass, colourless pyroxene, and green hornblende; spherical liquid cavities with bubble.

Pyroxene: Augite colourless, extinguishing up to 15°.

Hypersthene: Pleochroism green-blue / reddish-brown.

Hornblende: Well-formed crystals, green, pleochroism greenish-yellow / dark-brown / greenish-brown, fresh, without resorption border.

Biotite fresh, pleochroism bronze-yellow / greenish-black.

Magnetite in octahedral and other grains.

Apatite colourless fairly large crystals.

Glassy Rhyolite, containing plagioclase, pyroxene, and hornblende.

In the absence of quartz grains and the presence of so much undifferentiated glass it is impossible to say positively that this is a rhyolite. It may be the glassy form of a less acid rock. The specific gravity in small fragments is from 2·44 to 2·49.

Locality.—Upper tunnel, Ruapehu Claim, Owharoa district, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This rock is less cavernous than that from the lower tunnel, and lines of flow are more readily traced in the specimen under consideration.

No. 208/6.

M.C.—Rough cream-white stony-looking rhyolite, with numerous small phenocrysts of felspar, quartz, and ferro-magnesian mineral.

U.M.—A streaky alternation of quartz mosaic of various degrees of fineness; partly also consisting of small positive spherulites, sometimes with a centre formed of quartz mosaic.

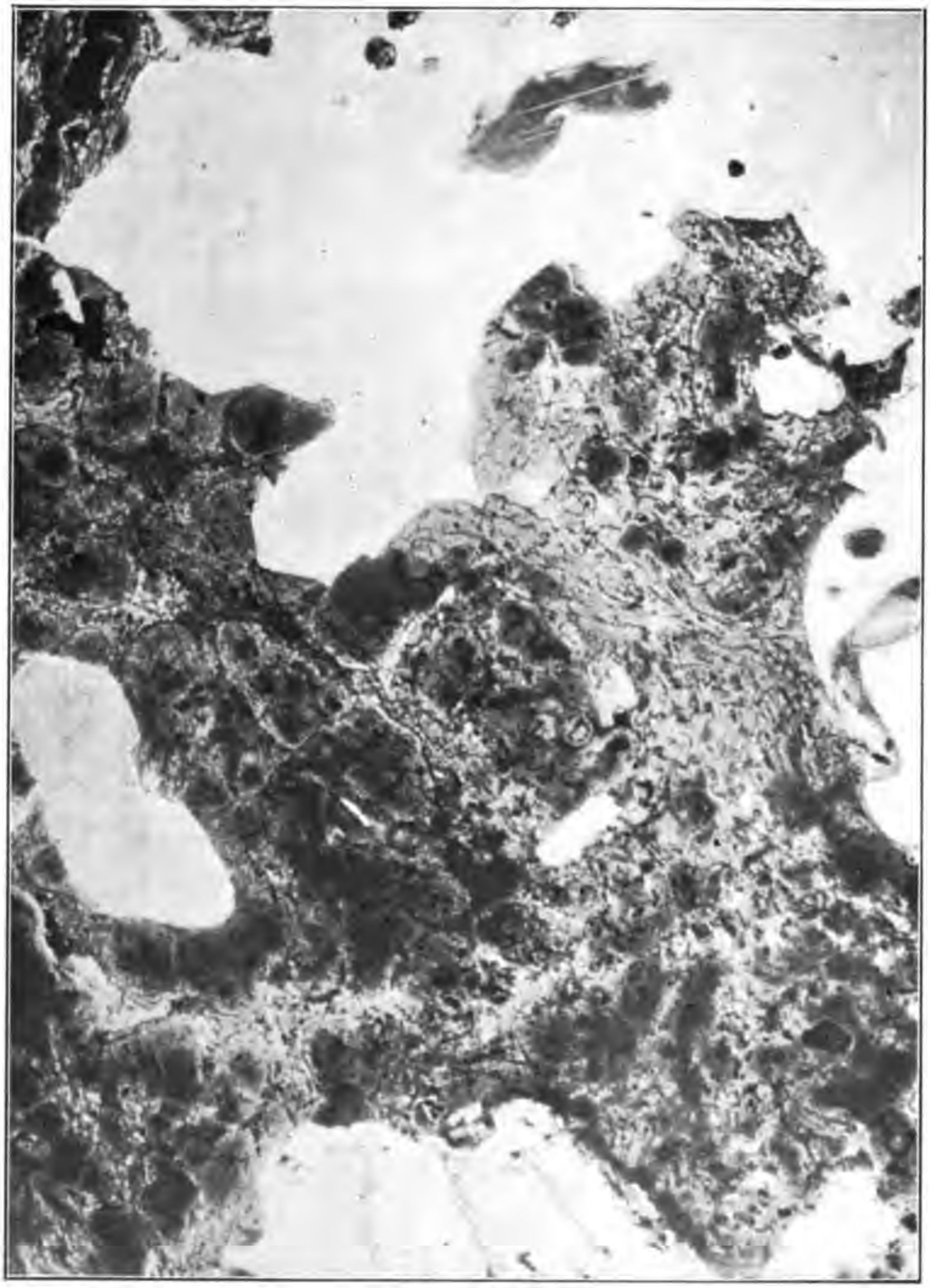
PHENOCRYSTS.—*Felspar* in numerous crystals, often of large size, but frequently fractured; fairly fresh, and then microperthitic, or replaced by muscovite or by quartz mosaics or pyrites, or by all of these.

Hornblende entirely replaced by quartz mosaics and pyrites.

Quartz in corroded grains of the usual rhyolitic character.

Leucoxene: Iron-stained after titaniferous magnetite.

Rhyolite, containing microperthite and hornblende largely replaced by quartz, with associated pyrites.



No. **209/21.** RHYOLITE.

[*To face p. 5, Vol. II.*

Locality.—The pool in the Ohinemuri River, a little below Owharoa, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This specimen is from the most westerly distinct outcrop of the Kapanga rocks at Owharoa, and though different in appearance from Nos. 1 and 3 or the spherulitic rocks that overlie and contain the gold-bearing reefs of Owharoa, it yet must be considered as lying at the base of the Kapanga rocks, as these are seen on the banks of the Ohinemuri River at and near Owharoa.

No. 209/21.

M.C.—A network of dark-grey material in which lie whitish spherules and phenocrysts.

U.M.—MATRIX complex; much consists of positive spherulites and spherulitic matter, brown by transmitted light, white by reflected light, and evidently decomposed. A few clear colourless spherulites with obvious fibres also occur. The spherulites lie in a network of minutely crystalline material of a green or yellow colour, which includes small colourless apparently isotropic bodies.

In many places the matrix consists of contorted streaks of green or yellow and colourless material; the greenish material may become parallel fibrous or radio-fibrous, and is probably a decomposition product.

PHENOCRYSTS.—*Plagioclase:* Fairly numerous corroded crystals, clear glassy appearance; *r.i.*, much above balsam; ext., 29°/33°, 20°/23°. Sometimes zonal; zones may be marked by contained glass. The corroding matrix is in some cases spherulitic.

Hornblende: Several corroded crystals; one large crystal, of which the greater part has been torn out in grinding the slice; brownish / greenish; in one case slightly corroded by biotite, in another passing into minutely crystalline yellowish material like that of the matrix.

Pyroxene: A few pseudomorphs in the minutely crystalline yellowish material.

Magnetite: A few crystals, fresh and undecomposed.

Ilmenite transformed, only a network remaining.

Quartz: A few colourless grains.

Rhyolite, containing plagioclase, hornblende, and quartz.

Illustration.—The slice shows strong contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, upper middle, which is fairly representative of the whole slice, as is the reproduction of a part only of the area mentioned.

Locality.—The north bank of the Ohinemuri, at the bridge leading to the Victoria Battery, Owharoa district, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This rock is exposed in both banks of the Ohinemuri River at and opposite Waikino. It in no sense resembles the Pliocene or Post-pliocene rhyolites that overlie it, and has never been confused therewith. On the contrary, this and the allied rocks of the lower Waitekauri Valley have been regarded as belonging to the older auriferous series, which has been regarded equal to the Thames-Tokatea group of the classification adopted in this report.

This rock clearly extends along the north-west side of the Waitekauri Valley for some distance, how far has not been exactly determined, but it probably does not reach further up the valley than the south-west end of the tunnel on the Waitekauri to Waikino Water-race.

No. 210/27.

M.C.—A black doleritic-looking rock with numerous obvious phenocrysts of felspar.

U.M.—MATRIX a brownish glass, crowded with long rectangular sections of plagioclase of various size, often once or twice twinned, arranged in streamlines; prisms of pyroxene, and grains of magnetite.

PHENOCRYSTS.—*Plagioclase*: Numerous crystals glassy-clear, with conspicuous inclusions of brown glass containing pyroxene microliths, often forming an irregular network. Sometimes zonal; generally elongated parallel to one cleavage; *r.i.*, above balsam; extinguishing from 22°/ 24° to 32°/ 34° (labradorite).

Hypersthene: Numerous large crystals; pleochroism faint salmon-pink / greenish-blue; contains inclusions of colourless augite. Sometimes inclusions of plagioclase occur, and liquid cavities with bubbles, having a spherical form or forming negative crystals.

Augite: Faint brown.

Magnetite in grains, and as dendritic growths and coarse irregular network in some crystals of hypersthene.

Ilmenite.

Clusters of phenocrysts occur in places, with associated glass, or a green finely crystalline material representing it, and containing long felspar prisms having a tendency to radiate growth.

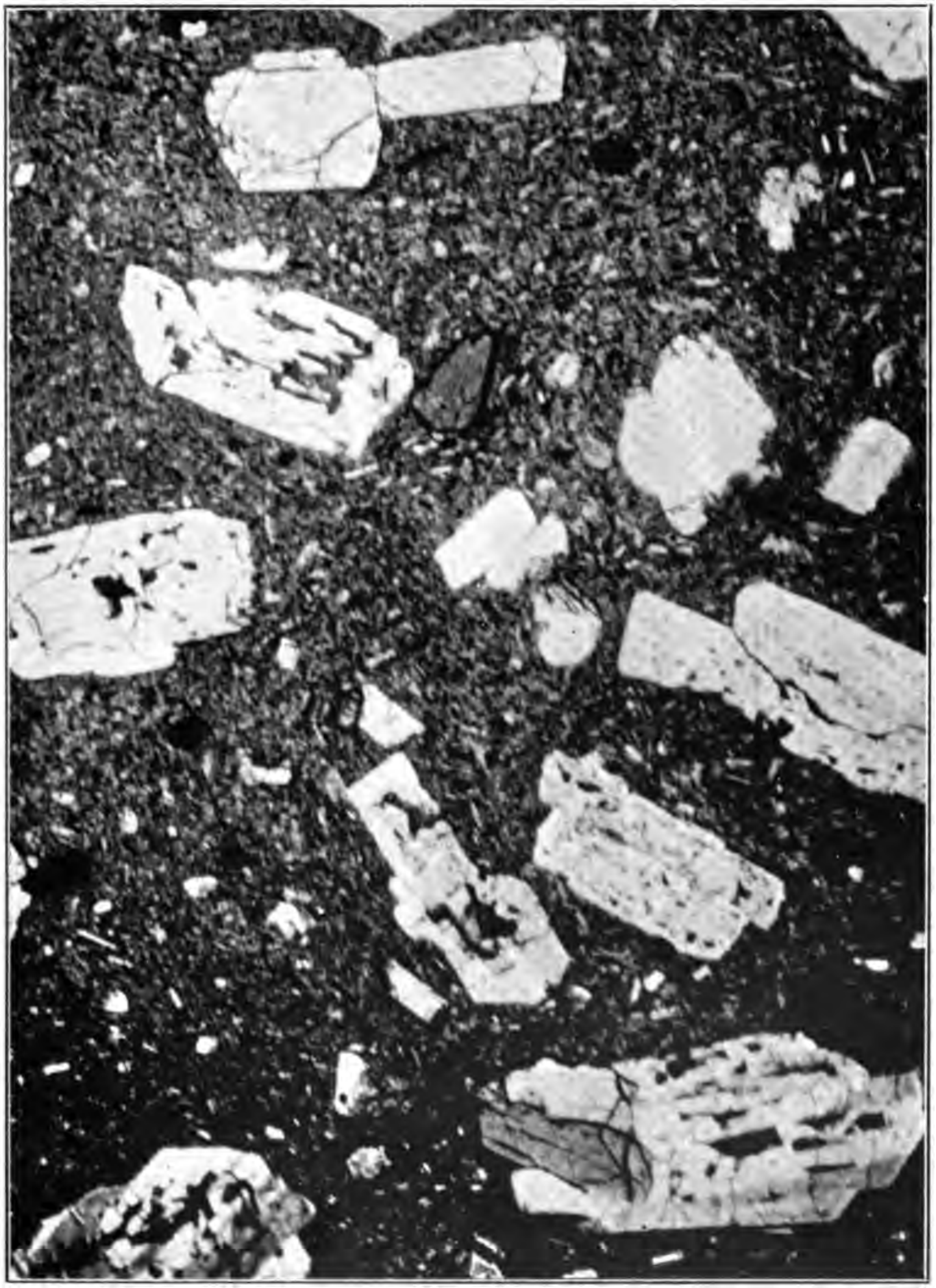
Black Hyalopilitic Hypersthene Andesite.

Illustration.—Slice shows good contrasts.

A. Photographed by polarised light; magnification, 60 diameters; area photographed, middle part, which, though not containing the largest phenocrysts, is yet fairly characteristic of the whole slice.

B. Photographed by polarised light; magnification, 112 diameters; area photographed, a little to the left of *a.* The magnification is too great to judge of the whole slice in the case of *b.*

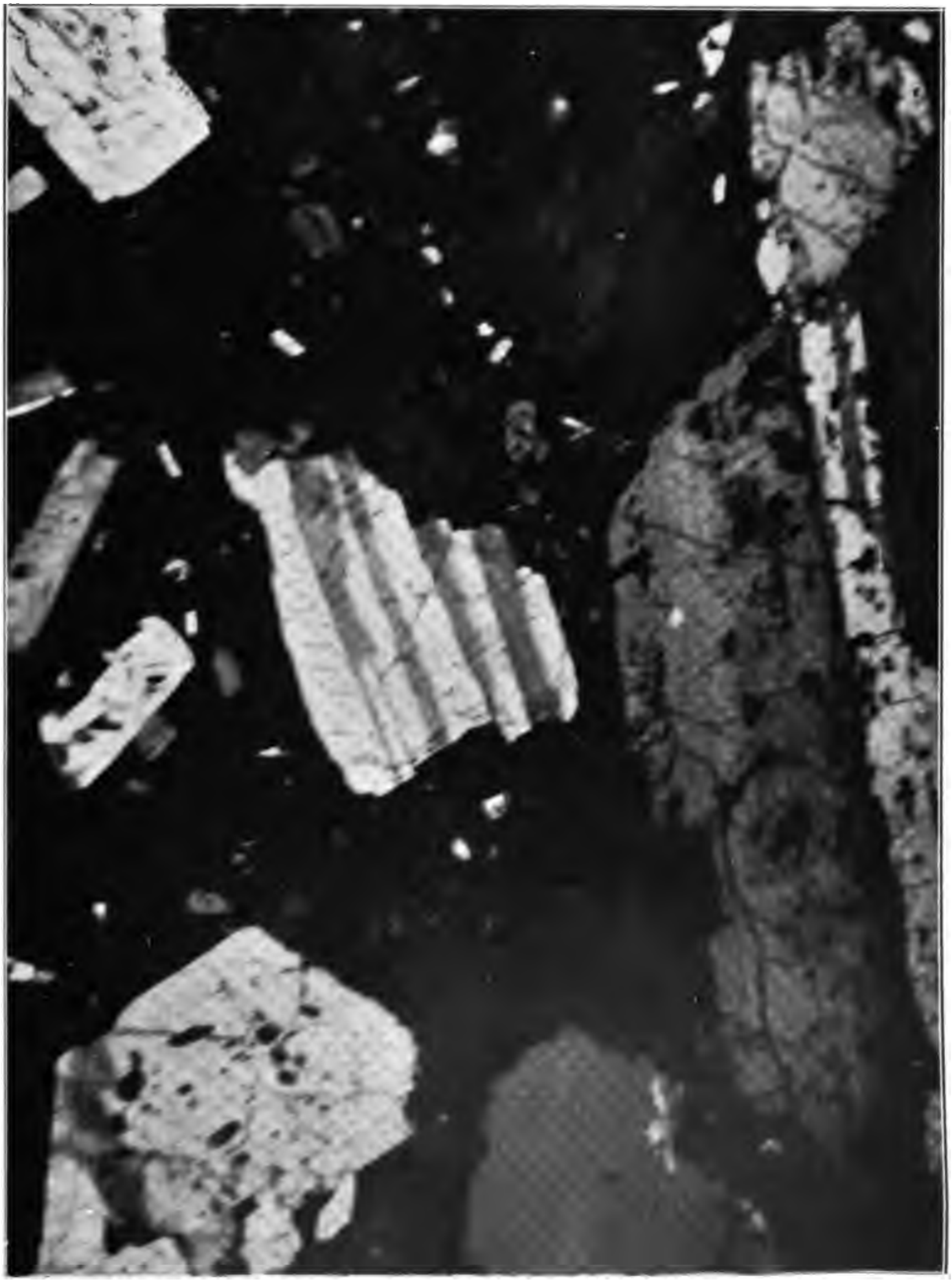
Locality.—Road quarry opposite Crown Battery, Karangahake district, Ohinemuri County.



No. 210/27A. HYALOPILITIC HYPERSTHENE ANDESITE.

[*To face p. 6, Vol. II.*

i.



No. 210/27B. HYALOPILITIC HYPERSTHENE ANDESITE.

[*To face p. 6, Vol. II.*
ii.

Formation.—Dyke in Thames-Tokatea group.

Remarks.—This is from what most likely is a continuation north of the dyke appearing in the Ohinemuri River bed at Karangahake, and which, continued further to the north, seems to be intruded into rocks of the Beeson's Island group, and consequently—though here it appears in connection with rocks of the Thames-Tokatea group—its date must be considered as after the deposition of the younger group.

No. 211/31.

M.C.—A green lustreless rock with opaque white phenocrysts of felspar.

U.M.—MATRIX minutely granulo-crystalline, in places pilotaxitic; numerous rectangles and laths of felspar arranged in stream-lines; occasional pseudomorphs after pyroxene, in chlorite. Leucoxene grains in clusters after ilmenite.

PHENOCRYSTS.—*Plagioclase :* Fairly numerous crystals, generally altered; when fresh *r.i.* above balsam; not uncommonly replaced by quartz in small grains.

Augite in fresh colourless crystals, but sometimes partly replaced by carbonates.

Hypersthene is represented by numerous pseudomorphs in green chlorite which extinguishes blue.

Ilmenite once fairly abundant, now represented by leucoxene. An irregular network of *quartz* in small grains, accompanied by *pyrites,* traverses the slice.

Hypersthene Andesite, altered by waters containing quartz and pyrites.

The pyrites in the quartz veins does not appear to result from alteration of the ilmenite in the rock, but to have been independently introduced. The rock was probably originally hyalopilitic.

Locality.—The prospecting drive immediately behind Tramway Hotel, Karangahake district, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—There is some suspicion that this and other rocks west of the Ohinemuri River and north of Karangahake Mountain, here placed as belonging to the Thames-Tokatea group, should rightly be referred to the Beeson's Island group, the rocks of which are in the close vicinity of whence the specimens were taken.

As regards the alteration of this particular rock, though not at the precise place, the district yet affords abundant proof of the prevalence of hot springs in the near neighbourhood, and the Woodstock main lode, a very heavy body of quartz on the north side of the Ohinemuri Gorge, strikes so as to pass near or under the Tramway Hotel.

No. 212/39.

M.C.—A black basalt-like rock, a compact matrix with scattered phenocrysts of felspar and ferro-magnesian minerals.

U.M.—An almost colourless glass densely crowded with lath-like felspar, prisms of pyroxene, crystals of magnetite arranged in stream-lines. The residual glass is very small in quantity, and this matrix makes the nearest approach to the pilotaxitic as originally defined by Rosenbusch. (It is to be noted that in our use of the term " pilotaxitic " is equivalent to the " micropœcillitic " of Williams.)

PHENOCRYSTS.—*Plagioclase* abundant, chiefly in complicated almost mosaic-like clusters; the outer individuals rich in glass-inclusions, and evidently grown in place; *r.i.*, above balsam; ext., 29°/30° (labradorite).

Augite abundant, sometimes in large crystals, frequently twinned, sometimes faintly pleochroic (not as observed in the slice, but in separated grains), faint-greenish in colour. A small quantity of calcite included in one specimen.

Hypersthene: Difficult to make out in the slice, since many sections with low double refraction extinguish like augite, and the pleochroism is faint. The minerals of the rock were therefore separated, and hypersthene with the usual pleochroism and quite fresh was found to be fairly common.

Some dubious pseudomorphs are present; a large phenocryst in carbonate the original nature of which is uncertain, and small green frequently rectangular sections of the same order of size as crystals of the matrix bordered by opacite. These remind one at first of hornblende with resorption borders, but they are chloritic pseudomorphs, it may be after hypersthene.

Black Hyalopilitic Andesite.

Illustration.—Slice shows good contrast of the different phenocrysts with the matrix.

Photographed by polarised light; magnification, 60 diameters; area photographed, middle part, which is characteristic of the slice.

Locality.—Quarries, Tararipi Creek, near Paeroa, Karangahake district, Ohinemuri County.

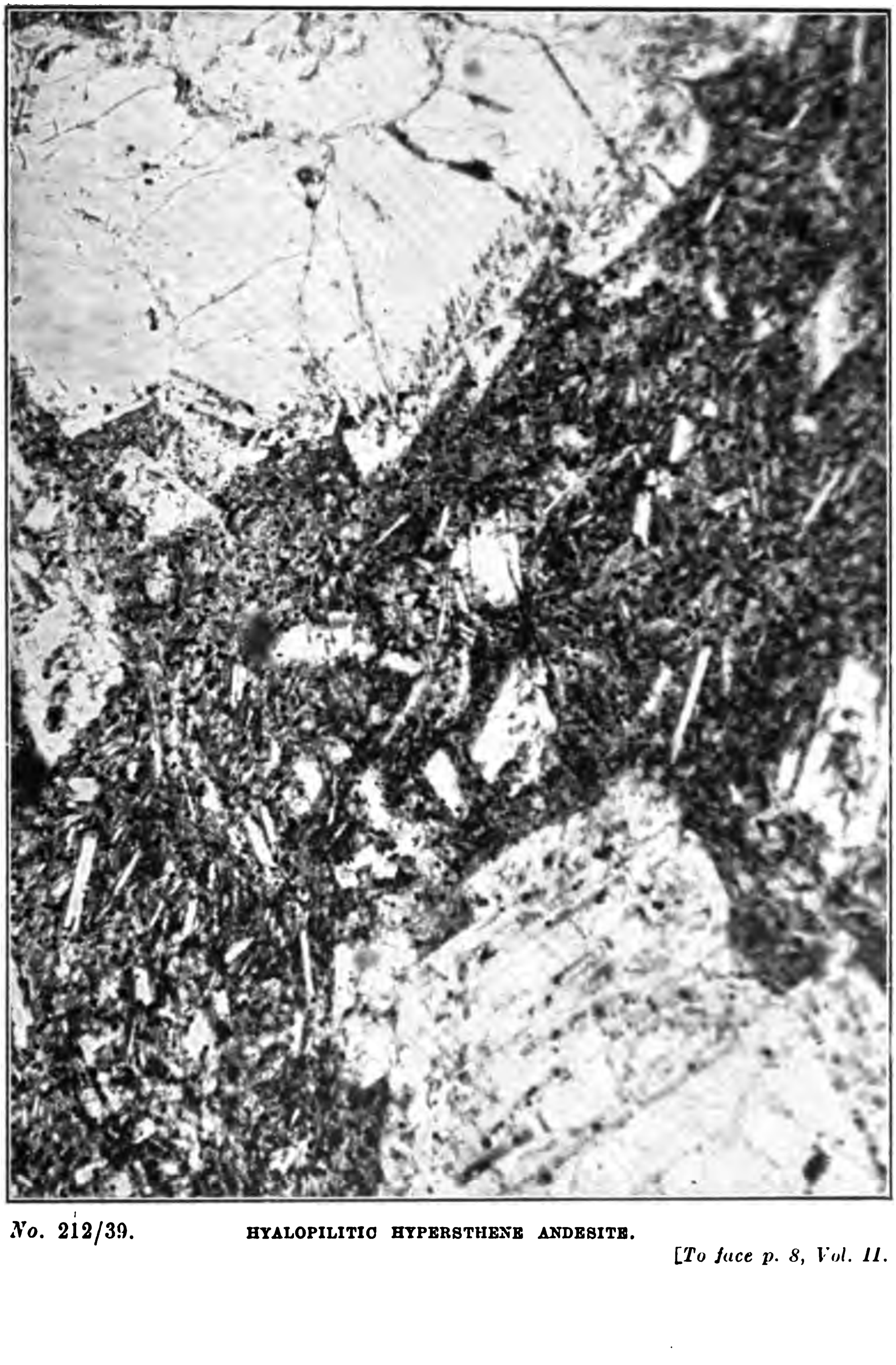
Formation.—Beeson's Island group.

Remarks.—This rock stretches along the lower western flanks of, and downs in front of, the range of mountains between the broad plain of the Thames Valley and the valley of the Waitekauri River, to the east of the principal mountain range.

No. 213/40.

M.C.—A greenish decomposed rock with evident felspar phenocrysts.

U.M.—MATRIX abundant, minutely crystalline, granular, with abundant plank-like felspar laths more or less altered or muscovitised; near phenocryst



No. 212/39. HYALOPILITIC HYPERSTHENE ANDESITE.

[*To face p. 8, Vol. II.*

in evident stream-lines. Small chloritic pseudomorphs; dusky quartz mosaics general throughout the matrix. Leucoxene in opaque white granules.

Phenocrysts.—*Felspar:* Numerous large sections, rectangular and six-sided after 010. All completely muscovitised. Original irregular net-like inclusions of glass now consist of yellow chloritic material. In some places partial replacement of the felspar by quartz.

Pyroxene represented by pseudomorphs in green chlorite polarising blue, or by quartz mosaics, or by a mixture of both. Pyrites sometimes accompanies the quartz.

Ilmenite in large hexagonal plates now converted into opaque white leucoxene, or in some instances into sphene.

Altered Andesite, partly replaced by subsequent quartz.

Locality.—No. 3 tunnel, Ravenswood Claim, Karangahake district, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—The sample is from the tip-head of the tunnel, and had been exposed for some time to the influence of the weather.

No. 214/42.

M.C.—A greenish-grey compact rock, matrix with opaque white felspar phenocrysts and dark-green ferro-magnesian phenocrysts.

U.M.—Matrix consists of a dusty, irregular mosaic of jagged quartz grains, with a few surviving long felspar laths; pseudomorphs in chlorite after pyroxene, and opaque white granules of leucoxene and black granules of magnetite.

Phenocrysts.—*Plagioclase:* Fairly abundant, but much torn out in grinding; some fresh; ext., 30° (labradorite), with lamellar twinning; some replaced by quartz and carbonates.

Pyroxene represented wholly by pseudomorphs in green chlorite, polarising bluish-green, with very faint pleochroism.

Magnetite: Titaniferous, with leucoxene border.

Altered Andesite, partly replaced by quartz.

Locality.—Docherty's Creek, west of Rahu Saddle, Ohinemuri County.

Formation.—Beeson's Island group.

Remarks.—This rock is from near the boundary of two formations, and may as likely belong to the Thames-Tokatea as to the Beeson's Island group. That the specimen is altered might seem to favour its belonging to the older formation, but its coming from close to the Ascot Terrace thermal pipe makes it probable that the specimen belongs to the Beeson's Island group, to which it has been referred.

No. 215/44.

M.C.—A greenish to bluish-grey lustreless rock, speckled white with felspar and green with chlorite.

U.M.—MATRIX small irregular quartz grains, often united into an irregular mosaic; felspar laths and rectangles in flow-lines; a good deal of disseminated chloritic matter, almost colourless; grains of leucoxene and magnetite, and small clusters of sphene.

PHENOCRYSTS. — *Plagioclase* in numerous well - formed crystals and clusters, some fresh; ext., 28°/32°; some replaced to some extent by carbonates. Zonal, and decomposing in zones of inclusions. A good deal torn out in grinding.

Pyroxene in pseudomorphs of green chlorite; sometimes with marked pleochroism, green / brownish-yellow; also of quartz and chlorite, with associated titaniferous magnetite. The quartz is rich in vapour cavities distributed in planes.

Horneblende: If ever present, rare. One or two pseudomorphs, with hexagonal outline and resorption border, suggest this mineral.

Ilmenite in six-sided plates, almost wholly converted into leucoxene.

Irregular vesicles, sometimes lined by iron-hydrate and scattered quartz grains and filled with chlorite, are not uncommon.

Altered Andesite, with subsequent quartz.

Locality.—Near the road from Paeroa to Te Aroha, at the western termination of the north-western spur from Karangahake, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—This rock may possibly belong to the Beeson's Island group, as the rocks of this group are found on all sides of the Karangahake area of Thames-Tokatea rocks, and rocks belonging to the Beeson's Island group are within a short distance of whence the specimen was taken.

No. 216/47.

M.C.—A pebble of whitish rhyolite.

U.M.—MATRIX contorted streaks of fibro-crystalline material, alternating with granular isotropic substance containing minute quartz grains, or with regular quartz mosaics. The fibro-crystalline material often presents a radiate spherulite-like character; the fibres have a positive sign.

Phenocrysts.—*Plagioclase:* Crystals and fragments; ext., 7° / 10°; not numerous.

Orthoclase: Large crystals, hexagonal, parallel with 010; *r.i.*, below that of balsam; ext., 23° with 110, 010; contains small prisms of apatite, not numerous; often broken.

Quartz: Numerous dihexahedra and grains, corroded by matrix.

Biotite: A few crystals highly pleochroic, dark-brown to black / straw-yellow; one contains a large crystal of *zircon*, which is not surrounded by a pleochroic halo. Some of the biotite crystals are corroded by the matrix.

Rhyolite.

Locality.—Raukekoro River, east side of the Bay of Plenty, Cook County.

Formation.—Acid rocks of the Taupo zone, which may be Pliocene or Recent.

Remarks.—The specimen was taken from the river-bed about ten miles inland from the shore of the Bay of Plenty.

No. 217/50.

M.C.—A heavy black basalt-looking rock with numerous phenocrysts of felspar.

U.M.—Matrix minutely granulo-crystalline, with here and there minute patches of dusky quartz, or even of pilotaxitic structure; slender felspar rectangles, having square or forked ends, running in stream-lines, fairly abundant, but less in bulk than the granulo-crystalline base.

Phenocrysts. — *Plagioclase:* Abundant well-formed crystals variously twinned, chiefly on the albite plan; ext., 25° / 26°, 30° / 32° (labradorite). Abundant and various inclusions, like those of glassy andesites, such as irregular networks and negative crystals, now converted into green alteration products, giving granular polarisation, probably chloritic. Opacite and pyrites are also present.

Pyroxene: Augite well-formed but corroded crystals, faint-green to almost colourless, sometimes twinned; ext., up to 42°.

Hypersthene nearly colourless, but still pleochroic, salmon-pink / bluish, some fairly fresh. Some only cores to bastite pseudomorphs. Some pseudomorphs without cores.

Magnetite grains without leucoxene borders.

Some very thin veins of quartz grains traverse the slice.

Black Hypersthene Andesite, with microgranular matrix.

Locality.—Track Karangahake to Paeroa - Te Aroha Road, Ohinemuri County.

Formation.—Beeson's Island group.

Remarks.—The high probability is that the rock belongs to the Beeson's Island group, which along the line of track reaches south beyond the general trend of the boundary-line between it and the Thames-Tokatea group. It is possible, however, that the specimen belongs to the latter group.

No. 218/51.

M.C.—Streaked reddish- and blackish-brown, with minute irregular ramifying vesicles, the walls of which are dusted with a violet-grey powder.

U.M.—MATRIX blotchy with darker and clearer areas; the darker are rich in red ferruginous granules, which are rarer in or even absent from the clearer matrix. The matrix is a colourless glass, crowded with microliths of felspar in flow-lines, minute granules of pyroxene, and magnetite.

PHENOCRYSTS.—*Plagioclase:* Numerous well-formed crystals, complicated growths, and fragments, with abundant glass-inclusions, regular and irregular twinning; ext., 30°/ 32° (labradorite).

Augite: Well-formed crystals and clusters (glomero-porphyritic), faint-greenish colour, sometimes orange at the margin; ext., up to 41°.

Hypersthene: Large fresh crystals and clusters; pleochroism greenish / pinkish; margins ochreous-yellow.

Hornblende: A few small corroded crystals, surrounded by a dense black border, sometimes invaded by the matrix, and then a second black border occurs within the crystal bounding the bay of matrix. Pleochroism intense rich crimson-brown / yellowish-brown; ext., from 0° to 4°, sometimes higher. Evidently closely allied to barkevicite.

Magnetite (opacite): A few large grains.

Some irregular vesicles are filled with an almost colourless glass, and may be bounded in parts by tridymite, but this is doubtful.

Hyalopilitic Hypersthene Andesite, containing a barkevicite - like amphibole.

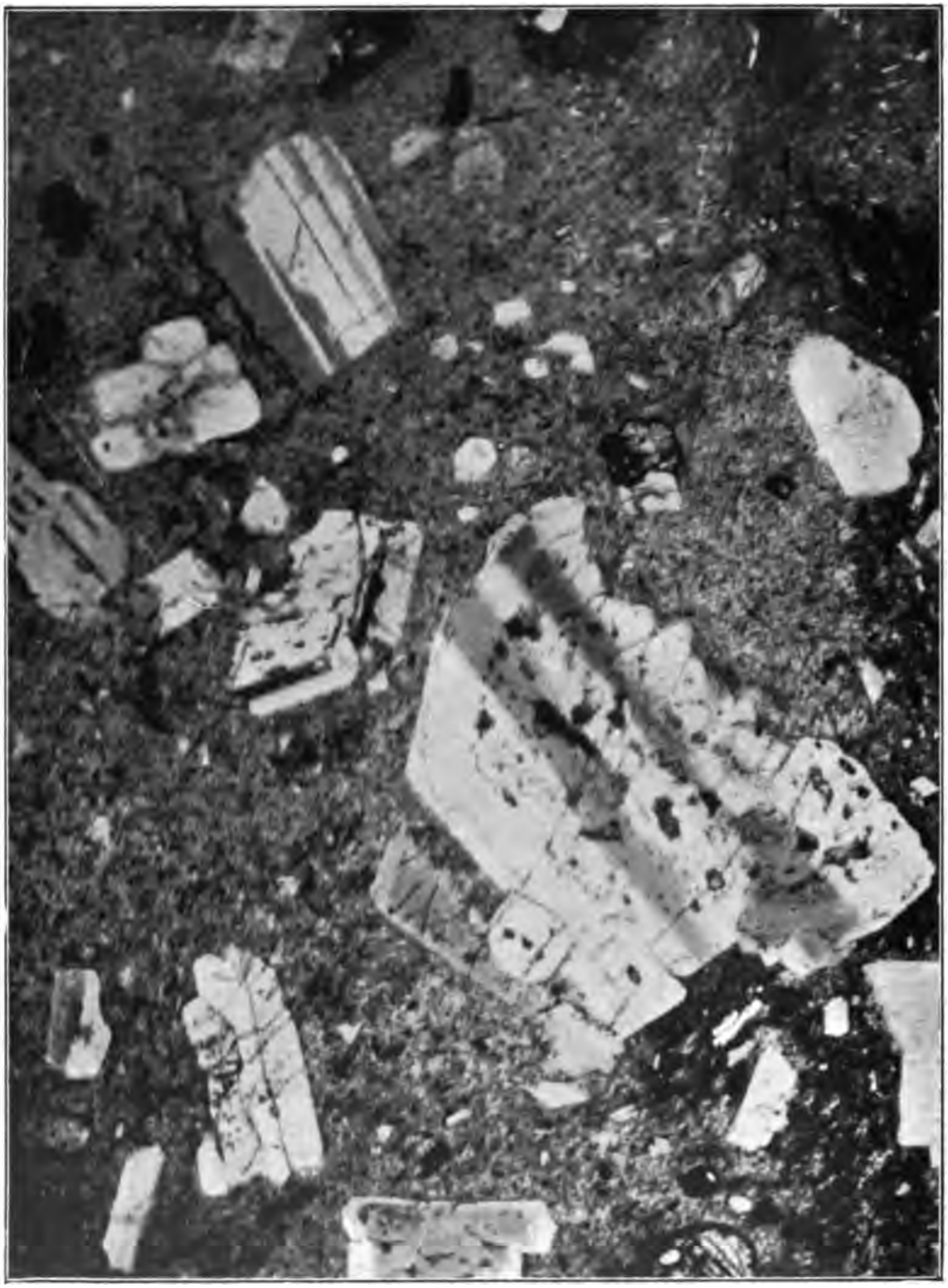
Locality.—Hills on the left bank of the Ohinemuri River, opposite Mackaytown, Ohinemuri County.

Formation.—Beeson's Island group.

Remarks.—The specimen is from a surface exposure of the rock, and its appearance as collected may be due to surface decomposition. The rock, however, is rather peculiar, and attracts attention from a considerable distance.

No. 219/64.

M.C.—A black basalt-like compact rock with evident felspar phenocrysts.



No. 219/64. **BLACK PILOTAXITIC HYPERSTHENE ANDESITE.**

[*To face p. 13, Vol. II.*

U.M. — MATRIX pilotaxitic; long felspar laths, usually minute, in stream-lines; minute opacite grains and rods, chlorite. Matrix about half the rock.

PHENOCRYST.—*Plagioclase:* Well-formed crystals and fragments, abundant; ext., 10°/13° to 23°/26° (andesine–labradorite). The smaller crystals, as usual, clearer and comparatively free from inclusions; the larger rich in inclusions of matrix and chlorite. Zonal.

Augite: Fresh well-formed crystals, faint greenish-blue in colour, with associated magnetite.

Hypersthene: Well-formed crystals converted into green bastite, cores remaining and sometimes retaining pleochroism.

Magnetite not abundant.

A few crystals of *apatite.*

Black Pilotaxitic Hypersthene Andesite.

Illustration.—Slice shows good contrast between the different parts.

Photographed by polarised light; magnification, 60 diameters; area photographed, upper middle, which is characteristic of the slice.

Locality.—Quarries half a mile above Mackaytown, on the road to Karangahake, Ohinemuri County.

Formation.—Beeson's Island group.

Remarks.—This rock most likely is a north continuation of the columnar dyke showing in the river-bed at Karangahake. This dyke, if its age is determined by that of the rocks which it penetrates, must be younger than the Beeson's Island rocks, and might therefore with propriety be referred to as of the same age as the post acidic basic intrusions of the main range east of Omahu Peak.

No. 220/87.

M.C.—A light-grey rock, with minute angular cavities, obvious felspars, biotite, and other ferro-magnesian minerals.

U.M.—MATRIX almost colourless glass, crowded with microliths of felspar in laths, rectangles, and thin hexagonal plates extended parallel to 010; the laths lie in stream-lines; prisms both augite and hypersthene, and grains of magnetite are very sparingly present. The rarity of magnetite grains is no doubt connected with the light colour of the rock. Small patches of greenish glass occur here and there with a higher refraction index than the colourless glass. Vesicles with lobate edges occur filled with colourless or orange-red glass, and are lined by colourless or yellowish chloritic material.

PHENOCRYSTS.—*Plagioclase* is predominant, but the phenocrysts do not make up together one-half of the rock, the matrix being in excess. The plagioclase occurs in large well-formed crystals and complicated growths, with various twinning, sometimes very irregular; *r.i.*, above balsam; ext., 26°/26°

(labradorite). Submarginal inclusions often form a fibrous layer of glass and felspar. Some of the crystals are clear and comparatively free from inclusions, some filled with a network of glass, or the glass may be so abundant as to reduce the crystal to a network of felspar. Small crystals of augite, biotite, apatite, and magnetite occur as inclusions; also negative crystals filled with colourless glass, within which is a bubble or a sphere filled with granular material.

Augite faint-greenish crystals and clusters; ext., up to 42°. Corroded crystals with numerous grains of magnetite.

Hypersthene : Fresh, fairly pleochroic, sometimes intergrown with augite; contains large rounded liquid cavities with bubbles.

Hornblende : Some large as well as small corroded crystals, green; pleochroism olive-green / straw-yellow; twinned, marked resorption border, but in some cases this is very thin. The resorption border consists of augite and magnetite in minute crystals.

Biotite : Several well-formed crystals, brown, with reaction border consisting of granules of magnetite, and small colourless prisms of an undetermined mineral; pleochroism straw-yellow / deep greenish-brown.

Quartz : Several sections look like corroded quartz grains, but give a biaxial figure. Unless this is due to strain, quartz is absent.

A small quantity of *tridymite* may be present. *Magnetite* is rare.

Light-grey Hyalopilitic Hypersthene Andesite, with hornblende and biotite.

Locality.—Black Hill, in the bend of the Ohinemuri, south of the Silverton Hills, Waihi district, Ohinemuri County.

Formation.—A columnar dyke breaking through rocks of the Kapanga group.

Remarks.—This rock weathers rapidly on exposure, and, except when deeply broken into, it is difficult to obtain fairly fresh specimens. The intrusive mass is columnar, but the prisms are small, seldom 6 in. in diameter.

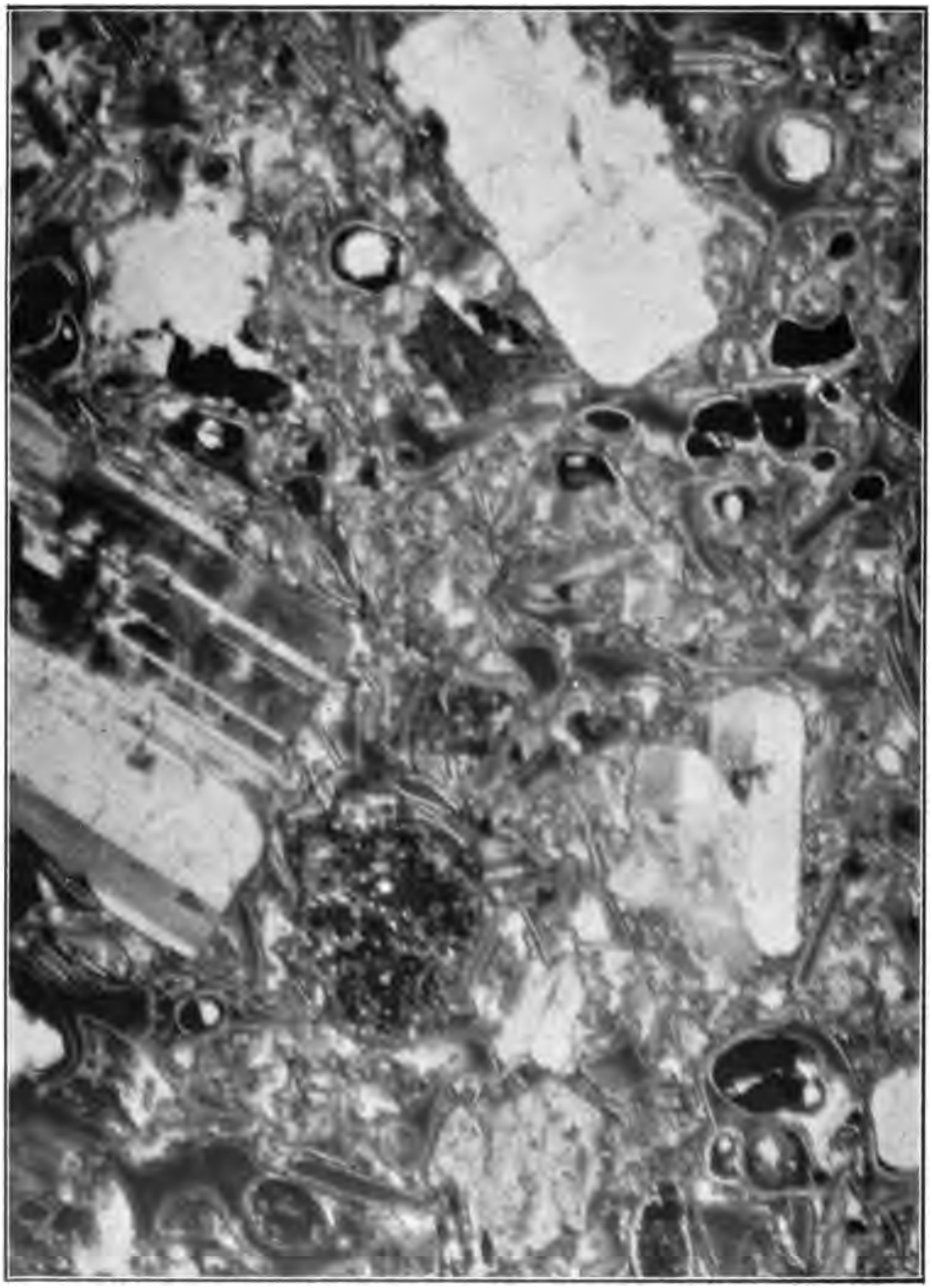
No. 221/91.

M.C.—A light violet-grey compact rhyolite with small phenocrysts of felspar.

U.M.—MATRIX forms the greater part of the rock; stream-lines shown by clearer and more granular contorted streaks; fibro-crystalline structure axiolitic and spherulitic, fibres giving positive sign. Some colourless glass.

PHENOCRYSTS.—*Plagioclase :* *r.i.*, above balsam; a few, generally broken, crystals.

Quartz : One or two fragments only.



No. 222/94. TUFF.

[*To face p.* 15, *Vol. II.*

Hornblende: A crystal or two of pale-green hornblende. No reaction border.

There are included fragments of positive spherulitic rhyolite, and quartz mosaics.

Rhyolite, with plagioclase.

Locality.—Middle part of the Upper Ohinemuri Plain, Waihi district.

Formation.—Acid group of Pliocene age.

Remarks.—This rock where the specimen was taken appears to break through, as an intrusive mass, the brecciated pumiceous and pitchstone rhyolites that are most in evidence between Waikino and Waihi. Elsewhere it would seem that this is not the true position of the rock, there being several places where it is seen to rest on the spherulitic rhyolites of Owharoa, or on rocks of the Kapanga group, and at the same time to underlie the pumiceous rhyolites.

No. 222/94.

M.C.—A grey friable tuff containing fragments of cream-coloured pumice and darker-coloured volcanic rocks.

U.M.—The rock is seen to be chiefly composed of shreds of brown glass curiously like the skeleton spicules of a Lithistid sponge; the margin of the glass colourless and clear; the interior ultra-microscopically granular and brown. The form of the shreds is due in the first place to the presence of round vesicles, which are sometimes quite spherical, sometimes, however, much elongated; and, secondarily, to fracture, which has taken place across the walls of the vesicles. The middle of some of the shreds is occupied with a foam of small vesicles. The clear margins of the glass are bordered by crystalline fibrous material. The vesicles and interstices between the shreds are filled with volcanic dust, except when the vesicles are empty.

Included fragments comprise lapilli of pumice, with characteristic elongated vesicles and colourless glass.

Plagioclase in entire and broken crystals; *r.i.*, above balsam; ext., from 15°/ 15° to 18°/ 18°.

Hypersthene rarely present. *Zircons* and fragments of glassy lava, with felspar pseudomorphs, are also present.

Tuff, containing fragments of pumice.

Illustration.—The slice shows fair contrasts, and afforded negatives of good quality.

Photographed by polarised light; magnification, 60 diameters; area photographed, lower left, which is not, in a slice so varied, quite characteristic of the whole.

Locality.—Coast range east of Waihi, where a tongue of the Ohinemuri Plain penetrates between two spurs of the range.

Formation.—Acid group of Pliocene age.

Remarks.—This rock occurs in the low grounds of a valley excavated in older rhyolites and the andesites of the coast range, and proves that subsequent to the commencement of the Pliocene acid outburst there were two distinct periods of eruption, both rhyolitic, and it may be there were three, the deposits of which are distinctly and highly unconformable to each other. The contact between the Wilsonite of Waikino and the eastern part of the Upper Ohinemuri Plain with the light-grey earthy rhyolites of Waihi and Waikino, as seen at the junction of the Waitekauri and the Ohinemuri, has all the appearance of high unconformity or faulting on a large scale, and the manner in which the tuff above described lies in a valley excavated in the spherulitic rhyolite of the hills bordering the plain shows this is highly unconformable to the rocks on which it rests. This tuff is easily distinguished from Wilsonite, but at the same time it is probably a contemporaneous rock.

No. 223/100.

M.C.—A greyish-white compact rock, containing minute crystals of pyrites, and traversed by quartz veins.

U.M.—MATRIX: A fine-grained mosaic of small jagged grains of quartz. Rows of minute opaque white granules remain to indicate the original presence of pyroxene prisms now wholly replaced by quartz.

PHENOCRYSTS.—*Felspar:* Some felspar material survives, but mostly muscovised and replaced by quartz.

Pyroxene represented solely by pseudomorphs in quartz mosaic, with which pyrites is frequently associated. The outlines of the pseudomorphs are marked by opaque white granules like those of the matrix, and such white outlines seem to be distinctive of the pyroxene pseudomorphs, since they do not occur round the felspar. This is a most perfect example of the replacement of pyroxene by quartz.

Pyrites: Numerous scattered cubes, and often surrounding leucoxene—a very suggestive association. Pyrites also in veins.

Quartz in corroded grains absent.

Very possibly this rock was originally an **Andesite.**

Locality.—Waihi Consolidated Mine, Silverton Hills, Waihi district.

Formation.—Kapanga group.

Remarks.—This rock should be one of the most altered in the whole collection. There can be no doubt that the Silverton Hills and the ridge thence north-east to the Waihi Consolidated was the scene of the most intense thermal action of which evidence remains in the Waihi district, and the conclusion is that the auriferous veins sought after on this claim were very contiguous to the thermal pipe of one of these sinter-depositing springs. The mine-shaft has been sunk through rock veined in all directions by quartz, so much so that the original rock is now fragments enclosed in a network of quartz veins, and yet the rock is not so much altered as to be beyond recognition. The opinion expressed that it was originally an andesite corresponds with its apparent continuity with the rocks of the Grand Junction Mine, which this more resembles than it does the rocks of the Waihi Union and the containing rocks of the Amaranth reef, which, according to the description of them, are rhyolite.

No. 224/107.

M.C.—A greenish-grey lustreless rock, with evident felspar and ferromagnesian phenocrysts, including also rounded fragments almost devoid of phenocrysts.

U.M.—MATRIX about half the bulk of the rock, forming an irregular network of quartz mosaic, with minutely granulo-crystalline material in the meshes; this seems to be chlorite; felspar laths muscovised; leucoxene granules. Some large crystals of apatite, some of which are longitudinally striated.

PHENOCRYSTS.—*Orthoclase* in rectangular and six-sided sections, the latter parallel to 010 and showing cleavage parallel to 001 and muscovitisation parallel to the axis z; ext., from 5° to 12° with axis x, and 19° to 24° with axis z. No evident synthetic twinning; no Carlsbad twinning; in rectangular sections the extinction is 0°. The *r.i.* is below balsam. Muscovitisation is general, but differs in amount, some much, and some only slightly altered.

This would seem to be an orthoclase containing some soda, but the specific gravity of most of it is over 2·61, perhaps in consequence of contained muscovite. To determine this a separation was made, and the material which floated above 2·61 was collected and examined. It proved to be muscovised felspar, and under the microscope gave the same extinction as had been observed in the slice; with the flame a strong sodium reaction and a fair potash reaction were obtained, but not so strong as would be expected from orthoclase. I conclude, therefore, that the felspar is a soda-bearing orthoclase.

Pyroxene is represented by pseudomorphs in faint-yellowish chlorite, which extinguishes parallel in faint-blue or neutral tint; its optic sign is positive with respect to the elongation. It may be pennine. Some of the sections recall hypersthene. A good deal of leucoxene is associated with the pseudomorphs, and some apatite.

Ilmenite is represented by numerous leucoxene nets and plates.

Pyrites: A few grains. Quartz phenocrysts are absent.

Quartz Pyroxene and Soda Orthoclase Rock, or Soda Pyroxene Rhyolite.

Locality.—Waihi-Silverton Mine, Waihi district.
Formation.—Kapanga group.

Remarks.—This rock has not hitherto been regarded as an acid rock, but in the field it is clearly different from the rocks of the Grand Junction Mine that may be considered to extend south and separate the Waihi-Silverton Hills from the rocks of Martha Hill and the Waihi Mine. There is reason to suppose that the rocks to the east of Martha Hill have been thrust to the north, but the Grand Junction area and the Silverton Hills are not displaced as regards their original position relative to each other.

No. 225/108.

M.C.—A yellowish and bluish-grey rock, roughly banded, lustreless, with large felspar crystals and altered ferro-magnesian minerals.

U.M.—MATRIX minutely granulo-crystalline, with dusky quartz mosaics composed of very irregular grains; a good deal of chlorite, leucoxene, and opacite granules.

PHENOCRYSTS.—*Orthoclase* as in the preceding rock (specimen No. 107), but retains traces of the microperthitic structure. Abundant.

Pyroxene: Fairly numerous pseudomorphs in faint-green pennine, pyrites and quartz associated.

Ilmenite: A good deal, represented by leucoxene and sphene.

Apatite: Many crystals, some striated, some in the matrix, some associated with chlorite pseudomorphs.

Quartz veins with pyrites, secondary.

Anorthoclase, or Microperthite Pyroxene Rhyolite.

Locality.—Waihi Union Mine, Silverton Hills, Waihi district.

Formation.—Kapanga group.

Remarks.—This rock hitherto has been considered an altered andesite or propylite, and its determination as a rhyolite is likely to lead (temporarily) to some confusion as to the distinctiveness of the different rhyolites in the neighbourhood of Waihi.

No. 226/110.

M.C.—A light-grey rock with obvious decomposed phenocrysts of felspar, soft enough to be scratched by the nail.

U.M.—MATRIX minutely crystalline, with scales of muscovite or kaolin, or both, and small quartz grains; in places indications of felspar laths, now converted into muscovite, in stream-lines. Small pyroxene prisms converted into colourless chlorite; numerous leucoxene and other granules.

PHENOCRYSTS: *Orthoclase* not abundant, some felspar substance remaining, much converted into muscovite or replaced by quartz.

Pyroxene: Some few pseudomorphs in quartz grains suggest by their outlines and associated leucoxene a derivation from pyroxene.

Pyrites generally disseminated.

Quartz: One or two rounded grains appear to be primary.

Secondary quartz in strings of mosaics, and in radio-fibrous growths, sometimes suggesting a replacement of original spherulites.

Anorthoclase (?) Pyroxene Rhyolite.

Locality.—Waihi Union No. 2 Mine, Waihi district

Formation.—Kapanga group.

Remarks.—The same as for specimen No. 108, the two rocks being from the near neighbourhood of each other.

No. 227/124.

M.C.—A blotchy purplish and grey rock with white phenocrysts of felspar, resorbed hornblende phenocrysts, and grains of quartz.

U.M.—MATRIX forms about half the rock, and consists of minute quartz grains, falspar laths, and rectangles, some with forked ends and rather thinly scattered in flow-lines; abundant greyish-white granules; rods and needles of opacite; minute octagonal and rectangular sections with red-brown margins filled with matrix and quartz mosaic, probably after hypersthene; pink-brown apatite with an axil canal.

PHENOCRYSTS.—*Plagioclase:* Large crystals and complex clusters, often broken and corroded; highly zonal; *r.i.*, above balsam; ext., 20°/26°. Numerous glass-inclusions with bubbles.

Hornblende represented by pseudomorphs most commonly of red ferric hydrate, which appears to result from the oxidation of magnetite, the remains of which are commonly present. The centre of the pseudomorph is sometimes occupied by quartz mosaic, and in a few rare instances a little residual hornblende may be met with; it is colourless and extinguishes at 24°.

Quartz in large and fairly numerous highly corroded grains; a few liquid cavities with bubbles. The matrix filling the gulfs that have resulted from corrosion of the quartz is sometimes radio-fibrous, spherulite-like.

Apatite is very abundant, iron-stained when free in the matrix, colourless when included in quartz.

Zircon: An occasional crystal.

Hornblende Dacite.

Zirkel, "Zeterbuch der Petrographie," p. 580, remarks, "A very beautiful dacite, green-grey groundmass with clear zonal plagioclase, black hornblende crystals, and sparse quartz grains, which may be compared with Timazite, occurs in the Thames district, in New Zealand" (F. W. Hutton, Roy. Soc. N.S.W., 7th August, 1889).

Illustration.—The slice shows good contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, middle part, which fairly represents the whole of the slice.

Locality. — The kilns, Waitekauri battery, Waitekauri district, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—Presumably on account of the presence of free quartz in large and fairly numerous grains this rock has been regarded as a rhyolite, and as the occurrence of this dacite rock lies in the line of the north-east extension of the spherulitic dacites and rhyolites of Owharoa the assumption was fairly warranted. But it was not of the Owharoa quartzose and spherulitic rocks that this Waitekauri dacite was supposed to be an extension, but of the younger rhyolites of Pliocene or Post Pliocene age that reaching into the lower valley, yet do not reach along this as far as the township and the locality of the specimen above described.

No. 228/127.

M.C.—A greyish-green rock with numerous phenocrysts of felspar, hornblende, and quartz, including rounded fragments of finer texture.

U.M.—MATRIX more than half the rock. It consists of quartz in irregular grains of most various size, frequently in micropœcillitic patches; forked felspar laths, not abundant, in flow-lines; black granules of opacite and leucoxene, and chlorite scales. Minute rod-like rows of opacite granules suggest replaced felspar laths.

PHENOCRYSTS.—*Plagioclase:* Numerous large crystals and complex growths and fragments, highly zonal, very irregular, twinning; *r.i.*, much above balsam; fresh, but many with carbonates in the centre. Inclusions of chlorite and apatite, but most marked of colourless glass, forming thickly strewn minute globules with contained bubble in zonal arrangement, or large negative crystals with bubble.

Pyroxene represented by numerous small pseudomorphs in chlorite.

Hornblende represented by black resorption pseudomorphs.

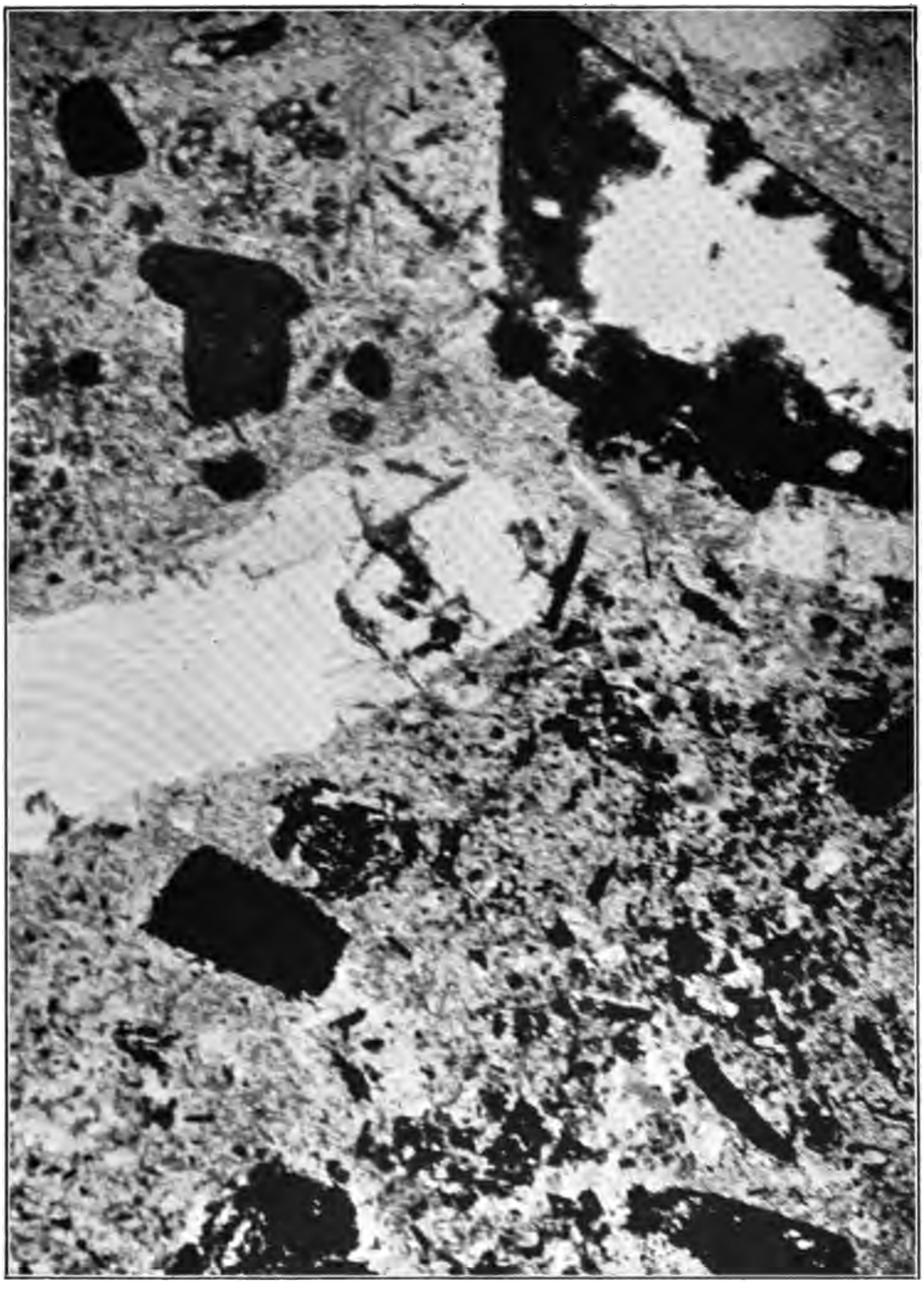
Quartz in numerous large highly corroded grains and bi-pyramids.

Ilmenite: Several large plates.

Apatite in numerous large striated prisms, some with an axial canal.

A curious growth of calcite in spherical concentric shells in one place.

Hornblende Dacite.



No. 227/124. HORNBLENDE DACITE.

[*To face p.* 20, *Vol. II.*

Locality.—The kilns near Waitekauri battery, Waitekauri district, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—The same as for specimen No. 124, both being collected from the same place.

No. 229/129.

M.C.—A greenish-grey rock, porphyritic, with felspar, hornblende, and quartz.

U.M.—MATRIX as in specimen No. 127.

PHENOCRYSTS.—*Plagioclase* as in No. 127.

Pyroxene: A few pseudomorphs in carbonates.

Hornblende: Resorption pseudomorphs more common than pyroxene.

Quartz in numerous corroded grains.

Ilmenite: A few large plates.

Apatite: Numerous large striated crystals; pleochroic, violet / faint yellowish-brown when present in the matrix, colourless when included in a phenocryst. A surprisingly large quantity of apatite.

Hornblende Dacite.

Locality.—The kilns near the Waitekauri Company's battery, Waitekauri district, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—The same as for specimen No. 127.

No. 230/133.

M.C.—A violet and yellowish-grey rock with obvious felspar and hornblende crystals.

U.M.—MATRIX forms the larger part of the rock, consisting chiefly of positive spherulitic material of various degrees of fineness. The fibres are sometimes very coarse; at other times very fine. Tridymite is also present. The rays of the coarse spherulites do not extinguish parallel, but up to 40°, and some are positive and some are negative. Some small negative spherulites are also present.

PHENOCRYSTS.—*Plagioclase* in large crystals, clusters, and fragments; *r.i.*, above balsam; ext., 18°/ 19° (andesine–labradorite). Some zonal, include colourless augite with associated magnetite, also glass and pseudomorphs in chlorite.

Hornblende: Reedy, green, pleochroism straw-yellow / green or brown, much torn out in grinding. Resorption borders present.

Pyroxene: A few pseudomorphs in chlorite and carbonates.

Biotite: Some corroded fragments with liberated magnetites, only visible under high magnification.

Magnetite, and some large striated crystals of *apatite.* An occasional *zircon.*

Quartz: A few corroded grains.

Spherulitic Dacite, or **Rhyolite:** A chemical analysis can only decide which. The phenocrysts distinctly indicate dacite. The groundmass may be acid enough, however, to carry the rock into the rhyolites.

Illustration.—Slice shows strong contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, middle part, which, not showing free quartz, can hardly be said to be characteristic of the slice; the contiguous area to the right shows a large grain of quartz, a deep gulf in the outline of which is filled with matrix.

Locality.—Long drive in Kinsella's Creek made by the Ohinemuri Syndicate, Waitekauri district.

Formation.—Kapanga group.

Remarks.—This rock is of interest, since it may be strictly compared with the rock showing in the banks of the Ohinemuri at Waikino, and in Boardinghouse Creek at the waterfall, and elsewhere in the same district. The fibrous material and spherulitic structure are not evident to the unassisted eye, and at first sight the rock might be fairly regarded as a quartzless representative of the Waitekauri dacites, or, without their spherulites, of the more hornblendic rocks at Owharoa. As a matter of fact, this rock does seem to connect the spherulitic dacites farther to the south-west with the dacites more to the north-east.

No. 231/147.

M.C.—A greenish-grey compact rock with phenocrysts of felspar and pyroxene.

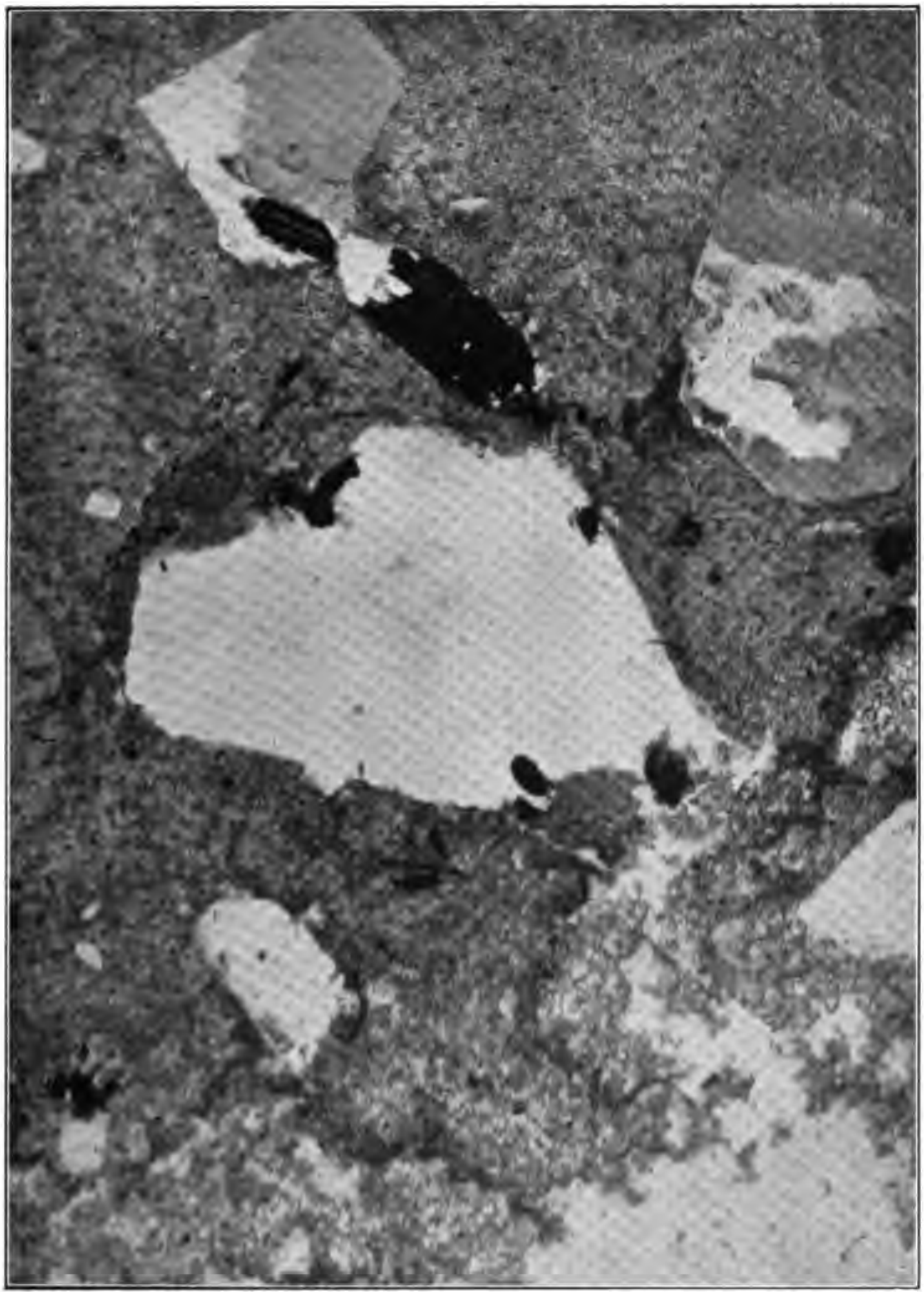
U.M.—Matrix minutely micropœcillitic quartz, with abundant plagioclase rectangles, and laths often with forked ends, once or twice twinned, arranged in stream-lines; chlorite scales and associated granules of epidote, also leucoxene.

Phenocrysts nearly one-half the rock.

Plagioclase: Abundant well-formed crystals, variously twinned; ext., 27°/27°, 35°/35°. Inclusions abundant, chlorite being the commonest; it may occupy the greater part of the interior. A little epidote is often associated with the chlorite, also secondary quartz.

Pyroxene: Not abundant, represented by pseudomorphs in serpentine and chlorite.

Ilmenite: A good deal, some with included pyrites, only slightly altered into leucoxene.



No. 230/133. SPHERULITIC DACITE OR RHYOLITE.

[*To face p.* 22, *Vol. II*

Apatite in large numerous crystals, colourless.

Grey Pyroxene Andesite.

Locality.—No. 6 drive, Ravenswood Mine, Karangahake district.

Formation.—Thames-Tokatea group.

Remarks.—This rock should also be found in the New Zealand Crown and Woodstock Mines to the south-west.

No. 232/155.

M.C. — A black basalt-like rock, porphyritic, with felspar and ferromagnesian crystals.

U.M. — MATRIX more than half the rock; an almost colourless glass (brown in small patches when devoid of microliths), crowded with laths and rectangles of felspar, prisms of pyroxene, and magnetite, lying in stream-lines.

PHENOCRYSTS.—*Plagioclase:* Well-formed crystals with rounded angles, fresh; ext., 30°/30° (labradorite). Zonal. A submarginal zone of inclusions, may be a few large glass cavities with bubbles, or a close fibrous layer. Crystals of hypersthene and augite are also included.

Augite: Well-formed crystals, greenish to colourless, extinguishing up to 43°.

Hypersthene: Fresh, green, usual pleochroism, both pyroxenes common; sometimes occur in glomeruli on the outside augite, then may be followed by felspar, and finally brown glass on exterior. Some *chlorophæite* may be associated.

Hornblende represented by a few resorption pseudomorphs.

Pseudomorphs in serpentine occur after (?)hypersthene.

Magnetite: A few octahedra.

Black Hyalopilitic Hypersthene Andesite, with a little hornblende.

Locality.—Rahu Saddle, old road from Mackaytown to Owharoa.

Formation.—Beeson's Island group.

Remarks.—This rock occurs overlying sedimentary beds with carbonised plant-remains, which extend along the east side of the range to the Ohinemuri River, and are there seen to rest on the Karangahake rock of the Thames-Tokatea group; otherwise at the locality of the specimen and on the west side of the saddle on Beeson's Island rocks. Owing to associated and superincumbent siliceous sinter-deposits the relation of this rock to the Thames-Tokatea group is not very clear,

No. 233/158.

M.C.—A grey lustreless rock, porphyritic, with felspar and ferro-magnesian minerals.

U.M. — MATRIX: Jagged quartz grains, various in size, often forming mosaics; felspar laths in stream-lines; pseudomorphs in colourless chlorite; magnetite grains. Matrix abundant, almost three-quarters of the rock.

PHENOCRYSTS.—*Plagioclase:* Large crystals, clusters, and fragments corroded by matrix; *r.i.*, above balsam. Inclusions, glass cavities with bubbles, opacite, and apatite.

Pyroxene represented by pseudomorphs in green chlorite; pleochroism green / faint-yellow; polarises in yellow tints; opacite, leucoxene, and apatite associated. The crystals are small, and not abundant.

Hornblende absent or rare.

Quartz: A few rounded grains, and some bi-pyramids; contain large cavities with immobile bubbles.

Magnetite passing into leucoxene; a good deal.

Apatite abundant.

Pyrites: A few crystals.

Pyroxene Dacite.

Locality.—Drive in the gully on south side of the Ohinemuri River, opposite suspension-bridge below Owharoa, Ohinemuri County.

Formation.—Beeson's Island group (?).

Remarks.—This rock does not much resemble the generality of the Beeson's Island rocks, and not at all the other rocks of this age in the same district.

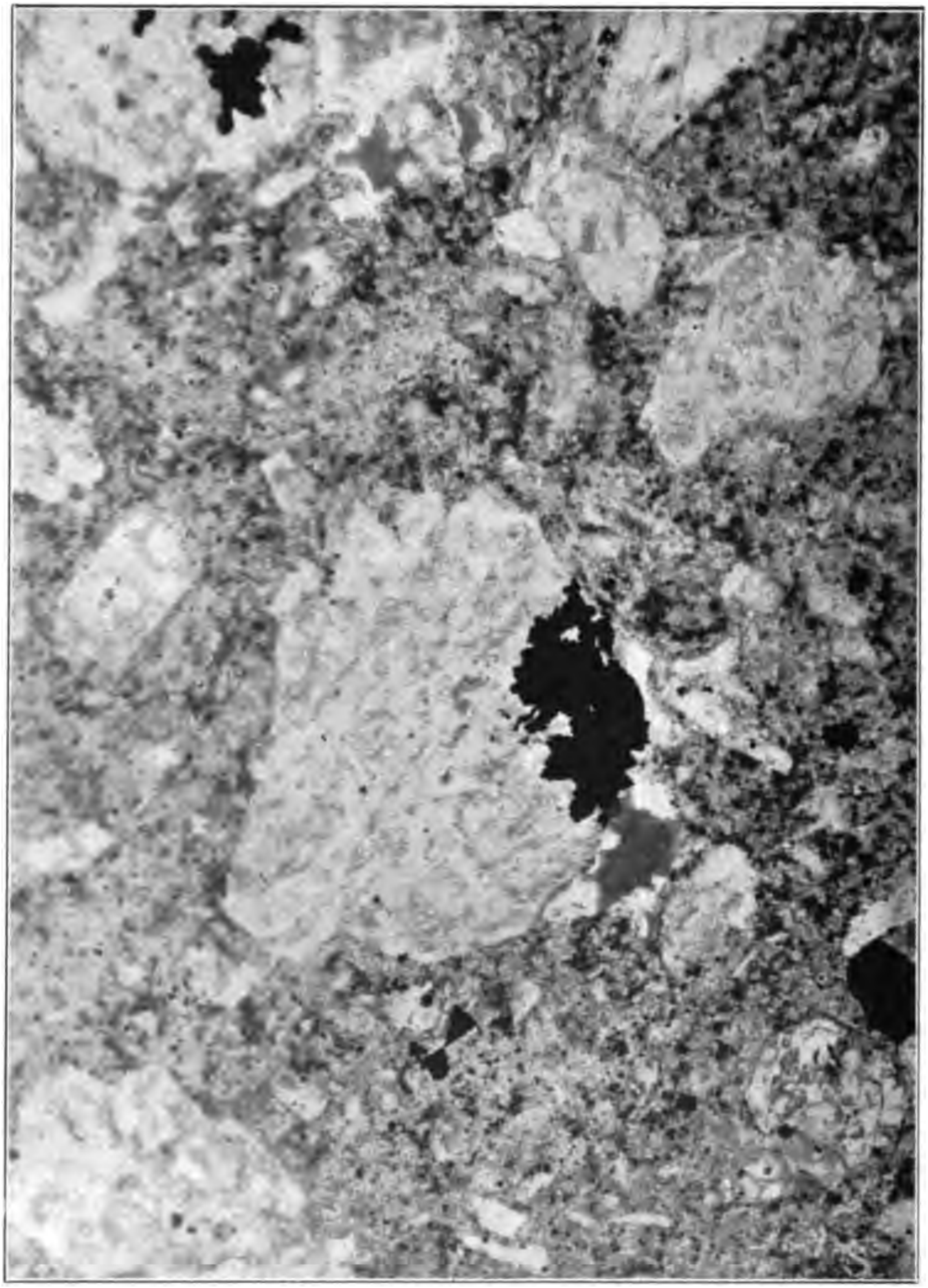
It is just possible that here there is an exposure of the Thames-Tokatea group as developed in Karangahake Mountain; but more probably the rock forms the basement of the Kapanga group as developed at Owharoa, and the diagnosis of its characteristics confirms the latter assumption. It has therefore been removed from the Beeson's Island group and placed with the Kapanga rocks.

No. 234/167.

M.C. — A greenish lustreless rock, porphyritic, with felspar and ferro-magnesian minerals.

U.M.—MATRIX: Jagged dusky quartz grains, muscovitised felspar laths and rectangles in stream-lines, chlorite pseudomorphs after pyroxene, and leucoxene granules.

PHENOCRYSTS.—*Felspar:* Numerous large crystals and complexes, completely transformed into carbonates and muscovite; a little quartz chlorite and pyrites also included. No evidence, except abundance of carbonate, of original character of felspar. Carbonates, however, suggest plagioclase.



No. 235/181. ALTERED ANDESITE (?).

[*To face p. 25, Vol. II.*

Pyroxene in pseudomorphs of quartz mosaic, chlorite, and sometimes also carbonates; leucoxene is generally intimately associated.

Ilmenite in large plates, transformed into leucoxene, fairly abundant.

Magnetite also converted into leucoxene.

Quartz phenocrysts are absent.

Irregular vesicular spaces now filled with chlorite and quartz.

Originally this may have been an **Andesite.** It is completely transformed.

Locality.—Upper end of the Ohinemuri Gorge, between the two tunnels in the bend of the river valley, Karangahake district, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—This is a greenish fine-grained rock; when collected it did not present the appearance of a much-decomposed rock, and as it had been recently exposed in the road-excavation it was taken as a fairly well preserved specimen. The divergence from its original condition is therefore by alteration at some distance from the surface, and the cutting-down of the Karangahake Gorge enabled its exposure in the position which has been indicated.

No. 235/181.

M.C.—A light bluish-grey porphyritic rock, with altered felspar and ferro-magnesian minerals.

U.M.—MATRIX: Dusty small irregular quartz granules; muscovitised felspar laths; leucoxene granules. Does not quite make up one-half the rock.

PHENOCRYSTS.—Altered *felspar, pyroxene,* and *ilmenite* as in specimen No. 167. Also vesicular spaces filled with chlorite and chalcedonic quartz. In this rock is seen a beautiful imitation of the canal system of Eozoon Canadense by thread-like growths of chlorite into quartz mosaic.

Probably an **Altered Andesite.**

Illustration.—The slice shows but moderate contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, upper middle, which is characteristic of the whole slice. The reproduction deserves passing notice on account of its excellence.

Locality.—Upper part of the Karangahake Gorge, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—From the road-line between the two tunnels, after passing through the deeper part of the gorge. Long exposure of this rock changes it to a yellowish or light-brown colour, which is its general character in the deeper part of the Ohinemuri Gorge.

No. 236/185.

M.C.—A greyish or violet-white earthy rhyolite.

U.M.—MATRIX constitutes nearly the whole of the rock; streaks of axiolitic material and occasional lenticules of small crystals and glass are present. The axiolitic material forms the greater part of the matrix.

PHENOCRYSTS.—*Plagioclase:* A few crystals and fragments, sometimes with, sometimes without, synthetic twinning, but *r.i.* always above balsam; ext., low; sometimes zonal.

Pyroxene: A few fragments transformed into chlorite, which polarises in brilliant colours.

Magnetite grains: A few.

Minute scales of *biotite* are present in the more coarsely crystallized parts.

Rhyolite, with a few phenocrysts of plagioclase felspar and pseudomorphs, probably after pyroxene.

Locality.—Nutt Tunnel, Owharoa district.

Formation.—Acid group of Pliocene age.

Remarks.—This rock rests directly on the spherulitic rhyolites and dacites of the Kapanga group, and, as far as this district is concerned, is the lowest rock of this younger acid group, and this relationship to the under- and over-lying rocks is seen at several places in the vicinity.

No. 237/199.

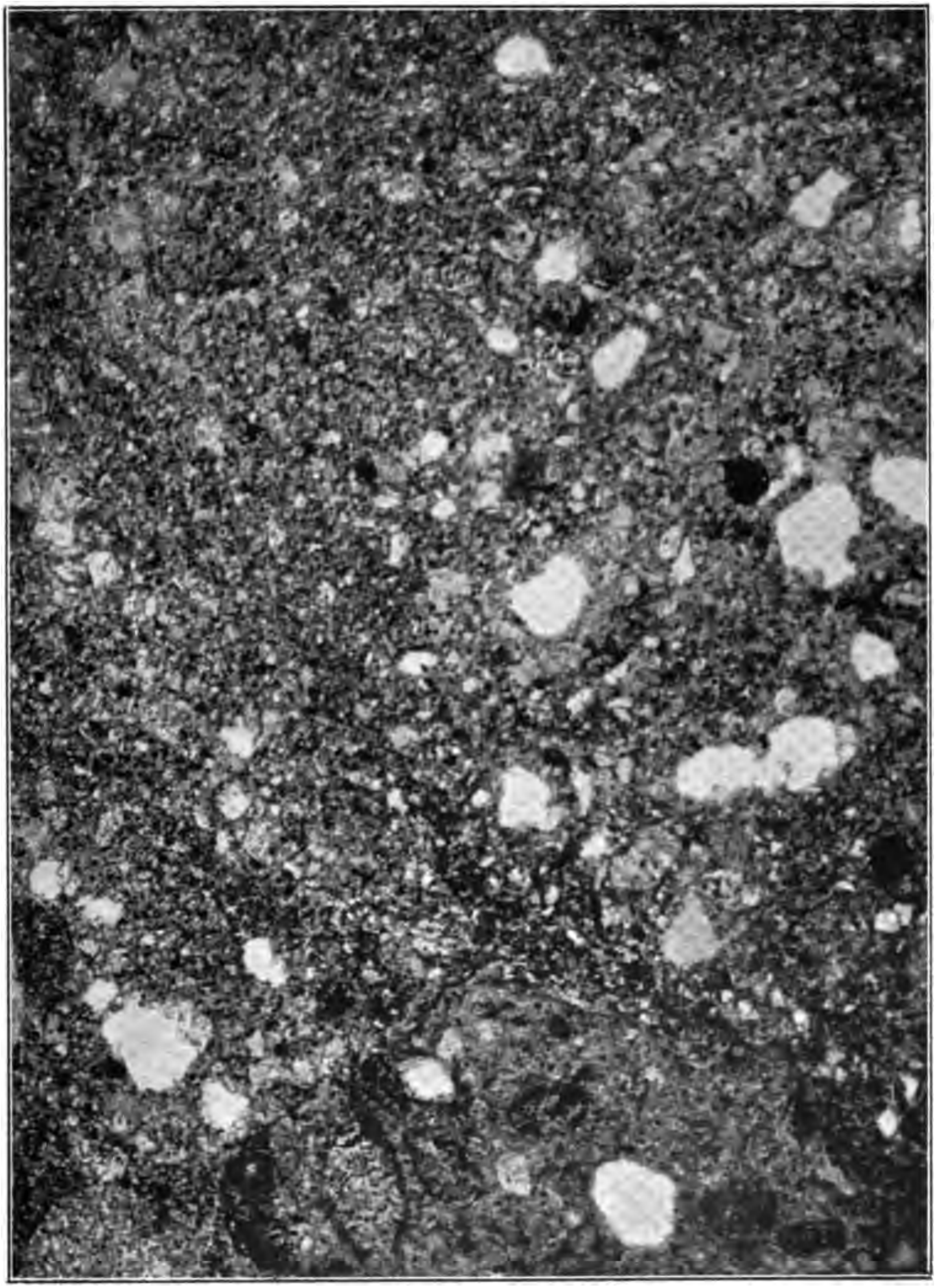
M.C.—A bluish-grey banded rock, with numerous angular included fragments.

U.M.—MATRIX minutely granular crystalline, filled with minute fragments and altered crystals of muscovitised felspar, pseudomorphs in chlorite, fragments of quartz, leucoxene granules, minute pyrites, granules and larger fragments of matrix of flow rocks reminding one of andesites, but no pumice nor shreds of vesicular glass now recognisable. The longer axis of some of the larger fragments points downwards at right angles to the direction of bedding.

A stratified fragmental volcanic rock.

Illustration.—There are moderate to good contrasts in different parts of the slice.

Photographed by polarised light; magnification, 60 diameters; area photographed, lower right, which, besides being generally representative of the other parts of the slice, shows also in the reproduction indications of bedding or flow-lines,



No. 237/199. STRATIFIED FRAGMENTAL VOLCANIC ROCK.

[*To face p. 26, Vol. II.*

and evident rounded inclusions having more or less the general character of the slice.

Locality.—Ravenswood Mine, on Woodstock main lode, Karangahake district.

Formation.—Thames-Tokatea group.

Remarks.—This and the adjacent rocks are distinctly stratified, and it can hardly be doubted that they were deposited under water; but it by no means follows that the deposits are marine. There are no fossil remains that might give indication of fresh-water or marine conditions; but in other parts of the peninsula where stratified rocks occur in connection with this or the other groups of volcanic rock the evidence is always that the conditions were fresh water.

No. 238/200.

M.C.—A light greenish-grey coarsely porphyritic rock, with numerous crystals of felspar and quartz.

U.M.—MATRIX: Angular irregular quartz grains, abundant muscovitised felspar laths in stream-lines, pseudomorphs in chlorite, and leucoxene granules.

PHENOCRYSTS.—*Felspar:* Large numerous crystals completely transformed into muscovite and carbonates, chiefly muscovite.

Pyroxene: Fairly numerous crystals, smaller than the felspar, represented by pseudomorphs in chlorite, with associated leucoxene; carbonates sometimes present, and a little quartz.

Quartz: Large grains highly corroded by the matrix, containing liquid inclusions with bubbles; inclusions sometimes form a negative crystal.

Ilmenite and *magnetite:* Fairly numerous crystals, usually altered to leucoxene.

This rock is so completely altered that it is difficult to say certainly what its original nature was; it may have been dacite. Although I suspected the presence of hornblende I could not make sure that it was originally present.

Dacite (?).

Locality.—No. 6 or lower tunnel of the Ravenswood Mine, on Woodstock main lode, Karangahake district.

Formation.—Thames-Tokatea group.

Remarks.—This rock, dacite in appearance, and containing free quartz, is reported abundant on the eastern slope of Karangahake Mountain, but after collecting the rocks of that locality there does not appear to be anything in the collection made that corresponds even fairly well with the rock above described. So far as could be made out, the general tendency of the deposits in the Karangahake Mountain and district is to dip to the south-east, and these rocks would, or should, therefore appear on the higher part of Karangahake. The spherulite rocks on Karangahake are mainly developed on the higher and western part of the mountain, and indicate a dip to the westward, so that it would appear that the eastern lower slope of the mountain indicates the presence of an anticlinal arrangement, and the Ravenswood rocks are so far to the eastward that they may not be represented on Karangahake.

No. 239/207.

M.C.—A bluish-grey rock, blotchy, with white felspar.

U.M.—MATRIX: Glass saturated with felspar microliths, the larger with forked or ragged ends, once or several times twinned; ext., 25°/30°; often mere shells filled with glass, running in stream-lines; pyroxene microliths and minute grains of magnetite are also present. The matrix constitutes at least one-half of the rock.

The patchy character seen in the hand-specimen is repeated in the slice, and is due to clearer tracks running through the darker matrix. As a rule, such clearing-up of the matrix corresponds with the development of the micropœcillitic structure, since the quartz (which is micropœcillitic) has about the same *r.i.* as the andesine it encloses; but in this instance there is no micropœcillitic structure and no quartz, and it would seem that the clarification is due to the disappearance of the minuter microliths and the introduction of glass and tridymite, or of a substance closely resembling tridymite.

PHENOCRYSTS.—*Plagioclase:* Numerous crystals and complexes, variously twinned; *r.i.*, above balsam; ext., 18°/18°, 25°/25° (andesine–labradorite); zonal, glassy-clear. Inclusions of augite, hypersthene, and negative crystals of glass.

Augite: Fairly numerous crystals and fragments of a light-green tint; ext., 40°.

Hypersthene: Somewhat more abundant than augite, fresh, with the usual pleochroism. Includes comparatively large crystals of apatite, and glass containing augite and magnetite. Hypersthene and augite associated in clusters, and sometimes in "reedy" bundles.

Magnetite: Numerous grains, with associated apatite, perhaps also ilmenite.

Quartz: A few grains of primary quartz.

Hyalopilitic Hypersthene Andesite.

Locality.—Wharekiraupunga, Waitekauri district, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—Rhyolites occur in connection with quartz lodes at Wharekiraupunga, but the relation of these to this rock has not been ascertained. Further to the north the pyroxene rhyolites of the Waihi Mine and Silverton Hills (near Waihi) have a strong development between the southern part of Whangamata Inlet and along the valley of the creek south of the track to the "Wires" in the Upper Tairua Valley.

No. 240/210.

M.C.—A greenish-grey compact rock, porphyritic, with white felspar and ferro-magnesian crystals, and scattered pyrites.

U.M.—Matrix phanero-crystalline, grains and bi-pyramids of quartz, rectangles of felspar, more or less muscovitised, pseudomorphs in chlorite, and granules of leucoxene.

Phenocrysts.—*Plagioclase:* Large, whole or broken crystals; some complexes. Synthetic twinning in most cases nearly disappeared; in some cases no synthetic twinning, and then the nature of the felspar is uncertain. Much altered by replacement by carbonates and development of muscovite.

Pyroxene represented by pseudomorphs in green chlorite polarising blue, with carbonates, often primary and with a marginal border; sometimes a little epidote is present.

Hornblende(?): Some pseudomorphs in carbonate have an hexagonal section suggesting hornblende.

Quartz: Large rounded much-corroded grains.

Ilmenite: Some hexagonal grains converted into leucoxene.

Pyrites in small cubes.

Pyroxene Dacite, or Dacite Porphyrite.

Locality.—Waitekauri Cross Mine, Waitekauri district.

Formation.—Kapanga group.

Remarks.—The specimen is from the tip-head of the mine, the rocks on which appeared to be much the same in character, and the actual position in the mine whence the specimen came was not determined. It would appear that dacite rocks are extended along the west side of the Waitekauri Valley for some distance above the township, but whether the pyroxene dacites of the Waitekauri Cross Mine are the same, continuous with, or by passage-beds are connected with the dacites near the township may for the present remain undetermined.

No. 241/212.

M.C.—A friable porous greenish-yellow rock, traversed by more compact violet streaks.

U.M.—Matrix partly positive spherulitic material, partly made up of felspar and an isotropic substance full of doubly refractive granules. In the spherulitic parts remains of trichites in stream-lines. The isotropic substance stains deeply with fuchsine. It is probably decomposed glass.

Phenocrysts. — *Plagioclase:* Numerous fresh phenocrysts; *r.i.*, above balsam; ext., 27°/29° (labradorite); some poor in inclusions, some filled with an irregular network of matrix. Frequently highly zonal. Fragments are numerous, often with secondary marginal growths.

Pyroxene: Augite faint-green crystals and fragments, not very numerous; ext., 40°.

Hypersthene more abundant than augite, fresh; marked pleochroism, of the usual tints.

Hornblende: Several small crystals and fragments, green, pleochroism faint straw-yellow / olive-green; a reaction border is not present.

Quartz: Several grains of corroded quartz.

Magnetite rather abundant, large grains.

A xenolith or two of andesite occur in the slice: one is a quartz hypersthene andesite, showing marked flow-structure; the other is an ophitic andesite.

The fragmentary nature of many of the phenocrysts and the presence of xenoliths suggest that this may be a " mixed " rock.

Spherulitic and Glassy Hornblende Hypersthene Dacite.

Locality.—The Whangamata Track, nine miles north of Waihi, Waihi district.

Formation.—Probably the acid group of Pliocene age.

Remarks.—This rock occurs on a high plateau, and can hardly be the same as the tuff of the low grounds east of the Silverton Hills, near Waihi. It much more resembles a massive development of acid rocks that appears on the coast-line some three miles to the south-east, and which corresponds better with some of the Owharoa rocks than any of the acid group of Pliocene age. It may therefore be that this is a rock of the Kapanga group.

No. 242/213.

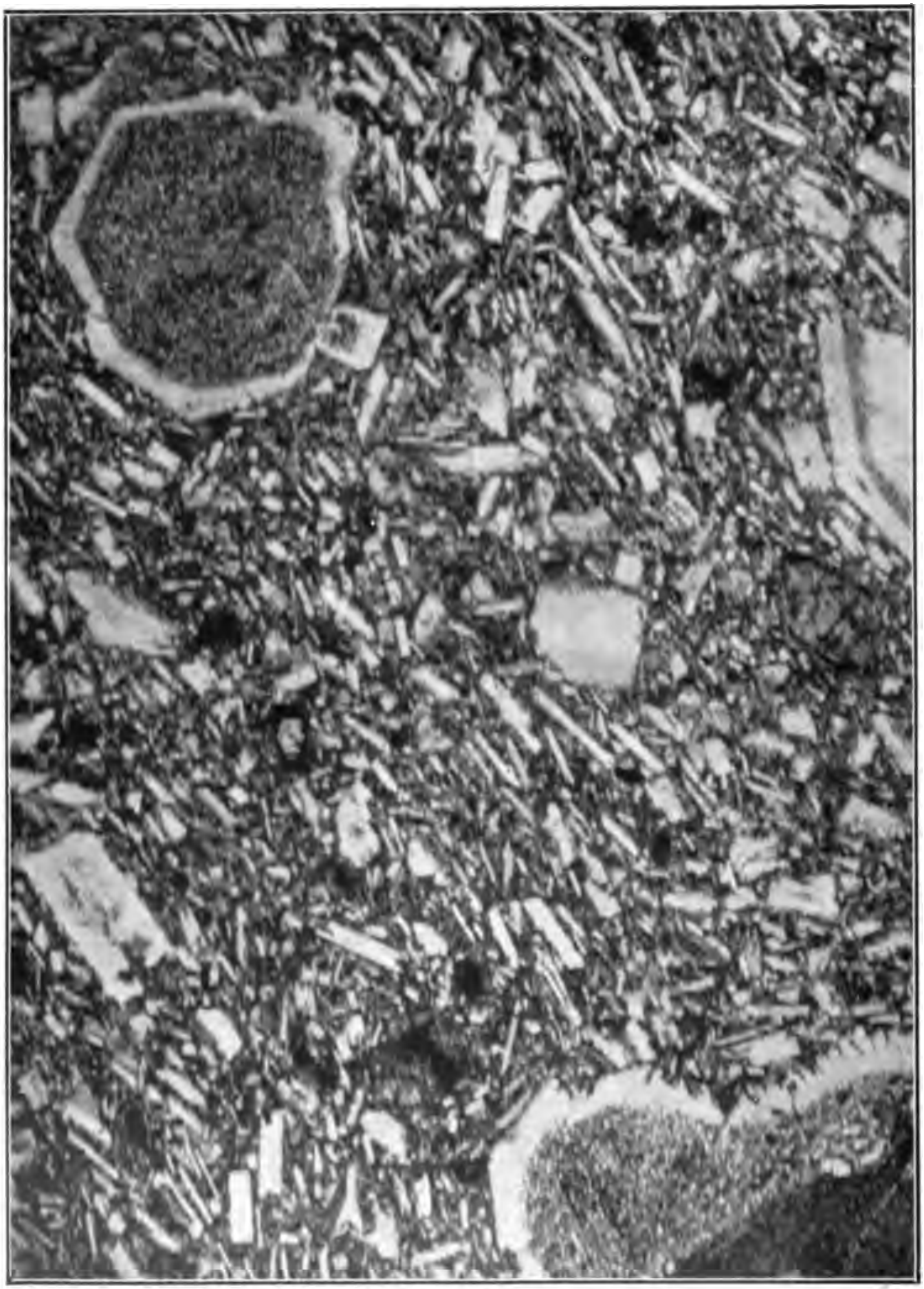
M.C.—A greyish-black compact rock, with a few scattered small phenocrysts of felspar.

U.M.—MATRIX forms the greater part of the rock, brownish granular glass densely charged with plagioclase laths of all sizes, from minute microliths up to large planks, lying in stream-lines, with abundant prisms of augite and hypersthene and minute octahedra of magnetite. The plagioclase, ext. at 21°/ 21° (andesine), frequently presents forked or ragged ends, and is sometimes filled with glass. Tridymite is also present.

PHENOCRYSTS.—*Plagioclase:* Large crystals and complexes, not numerous; generally rich in inclusions, filling the interior along parallel lines as a kind of network, but always leaving the marginal zone clear; *r.i.*, above balsam; ext., from 18°/ 18° to 30°/ 30° (andesine–labradorite). The inclusions consist for the most part of pyroxene and glass.

Augite: Small crystals, faint-green tint, ext. up to 45°.

Hypersthene more abundant than augite, fresh, with the usual pleochroism. Some extraordinary intergrowths of hypersthene and augite occur. Numerous small prisms of hypersthene, lying for the most part parallel, but not wholly so, are shot through with augite to form a complex, the augite of which extin-



No. 242/213. HYALOPILITIC HYPERSTHENE ANDESITE.

[*To face p. 31, Vol. II.*

guishes simultaneously, as does the hypersthene which lies parallel. Cavities lined by tridymite and filled with glass, as well as crystals of plagioclase; augite and a green undetermined mineral are included within this network growth.

Olivine: Numerous small crystals of olivine, with a reaction border formed of hypersthene and magnetite, the latter in the curious dendritic forms which have been figured by Judd.

The rock may be called a **Hyalopilitic Hypersthene Andesite,** or **Hypersthene Basalt.**

Illustration.—Slice shows good contrasts of the different parts.

Photographed by polarised light; magnification, 60 diameters; area photographed, middle part, which is characteristic of the whole slice.

Locality.—South-west side of the Upper Ohinemuri Plain, Waihi district.

Formation.—Beeson's Island group.

Remarks.—This rock was not obtained *in situ*, but unquestionably has been derived from the hills that, formed of Beeson's Island rocks, lie between the Upper Ohinemuri Plain and the upper valley of the Waitawheta River, there being, so far as known, no rocks of greater age in this direction till reaching Te Aroha.

No. 243/217.

M.C. — A greyish-black rock, platy, large felspar, and small ferro-magnesian phenocrysts.

U.M. — MATRIX colourless glass, crowded with felspar microliths and small crystals in stream-lines; minute pyroxene granules, a few, and no larger crystals; grains of magnetite. Matrix about half the rock.

PHENOCRYSTS.—*Plagioclase:* Well-formed as well as broken crystals; zonal; ext., 31°/32° (labradorite). General or submarginal inclusions of colourless glass, often giving a fibrous appearance to the felspar, the fibres being elongated negative crystals of glass.

Augite: Numerous well-formed crystals, faint-greenish colour, traces of pleochroism, twinned; ext., 42°/43°; intergrown with plagioclase in glomeruli; intergrown with hypersthene in compound crystals.

Hypersthene: Numerous fresh crystals, very obvious pleochroism, sherry-yellow or topaz-yellow / bluish-green or greenish-blue. Glass-inclusions numerous, round, or in form of negative crystals.

Biotite: A few very minute films, associated with quartz in a minute vein.

Olivine(?) : Some serpentine pseudomorphs have much the form of olivine. They are not numerous, and may only represent hypersthene, but I do not think so. The hypersthene, which is sometimes associated with them, lies around and, as a rule, not within the serpentine. This is the relation which hypersthene has to olivine in Nos. 37, 213, and 242, and the probability is that the serpentine is derived from olivine. This conclusion finds confirmation in the fact that much magnetite sometimes occurs in the middle of this hypersthene, suggesting vanished olivine.

Magnetite: A few grains.

Hyalopilitic Hypersthene Andesite, with serpentine after olivine.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 60 diameters; displaying one large crystal fragment; zoned, twinned, and showing inclusions.

Locality.—Road-metal quarries, isolated hills near Township of Paeroa, Ohinemuri County.

Formation.—Beeson's Island group.

Remarks.—In mass this is a coarse flaggy rock. The hills formed of it stand well forward into the Waitoa Plain, and indicate the former existence of large masses of volcanic rock that have now disappeared.

No. 244/231.

M.C.—A dark bluish-grey almost black rock, weathering greenish-grey, porphyritic, with fairly large felspar crystals.

U.M.—MATRIX formed of micropœcillitic quartz grains and abundant felspar planks in stream-lines, leucoxene and opacite granules, chlorite pseudomorphs, and abundant carbonates. Matrix abundant, more than half the rock.

PHENOCRYSTS.—*Plagioclase:* Numerous large crystals and complexes, much of it quite fresh, carbonates developed in some; various twinning; *r.i.*, above balsam; ext., 10°/ 10° (andesine); some with thread-like glass-inclusions, and corroded by the matrix.

Pyroxene: Large crystals entirely converted into carbonates and chlorite; leucoxene associated. Glomeruli of felspar and pyroxene present.

Quartz: Some large corroded grains.

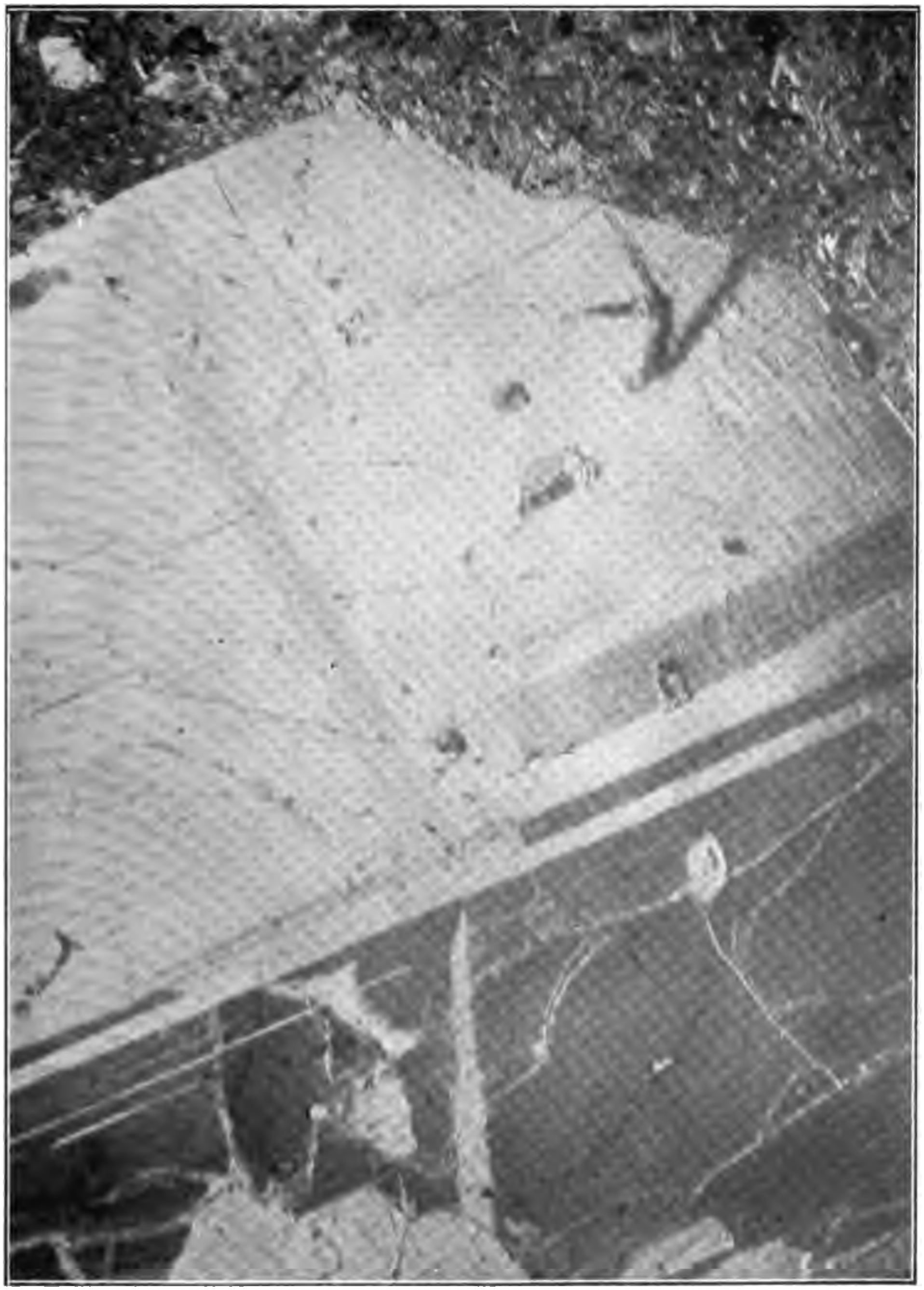
Ilmenite and *magnetite:* Ilmenite altered to sphene in some cases.

Zircon: One or two large crystals.

Pyroxene Dacite.

Illustration.—Slice shows good contrasts.

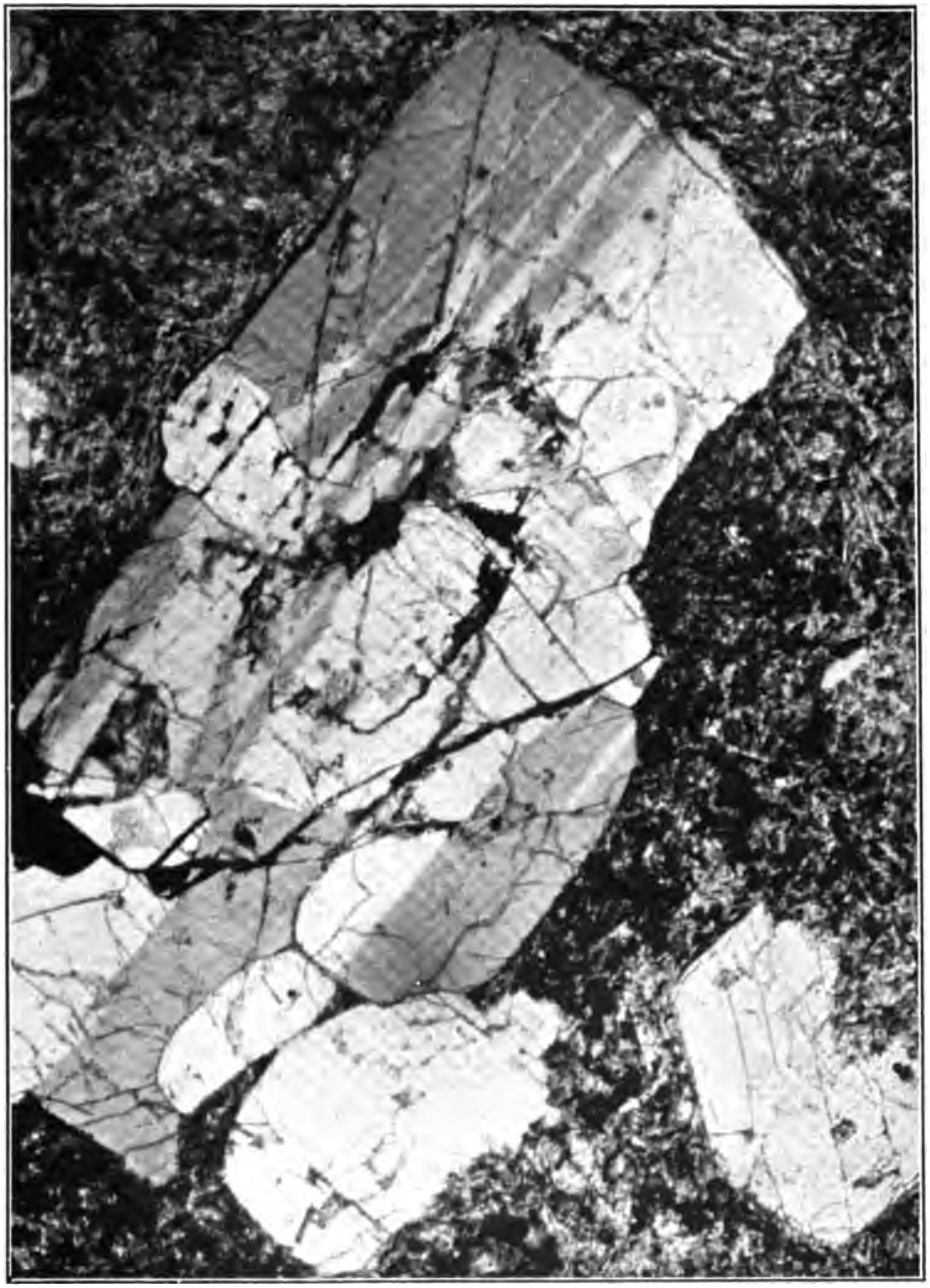
Photographed by polarised light; magnification, 60 diameters; area photographed, upper middle part, which may be regarded as characteristic of the rest of the slice, the phenocrysts represented being neither the largest nor the smallest, and the matrix similar throughout the slice.



No. 243/217. HYALOPILITIC HYPERSTHENE ANDESITE.

[*To face p. 32, Vol. II.*

i.

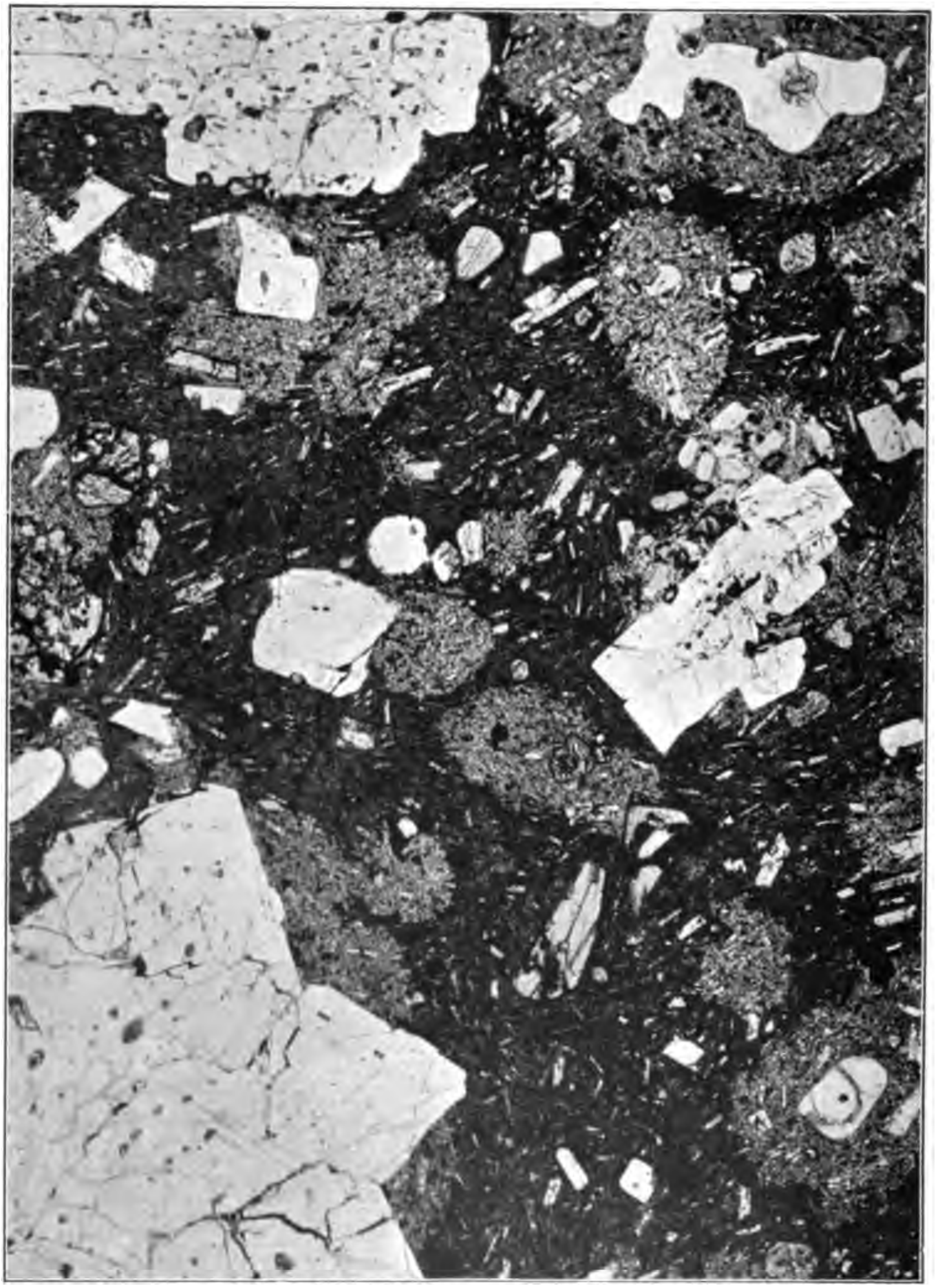


No. 244/231.

PYROXENE DACITE.

[To face p. 32, Vol. II.

ii.



No. 245/248. BLACK HYPERSTHENE DACITE.

[*To face p. 33, Vol. II.*

Locality.—Road-metal quarry, the second west of Owharoa, Ohinemuri County.
Formation.—Beeson's Island group.
Remarks.—This rock is easily distinguished from the darker, almost black, andesites higher up or lower in the valley.

No. 245/248.

M.C.—A dark compact rock, with large lustrous crystals of plagioclase and pyroxene.

U.M.—MATRIX: Felspar laths in steam-lines, crowded with minute granules of quartz, minute prisms of pyroxene, leucoxene and magnetite granules. Blotches of micropœcillitic structure spotted about abundantly; in some instances a corroded phenocryst of quartz serves as a nucleus to one of these patches.

PHENOCRYSTS.—*Plagioclase:* Numerous large well-formed crystals and complex growths, fresh, variously twinned, and which include small grains of augite; some filled with a glass net, the margin remaining clear; *r.i.*, above balsam; ext., 15°/ 15° to 23°/ 23° (andesine).

Augite: A few crystals and fragments, faint bluish-green, extinguishing up to 45°.

Hypersthene: A few large crystals and fragments beginning to pass into green serpentine.

Quartz: Numerous highly corroded grains without any fringe of green augite crystals; probably original.

Ilmenite and *magnetite* fresh, not passing into leucoxene.

Black Hypersthene Dacite.

Illustration.—Slice shows good contrast in all its parts.

Photographed by ordinary light; magnification, 33 diameters; area photographed, middle part, which is generally characteristic of the rest of the slice.

A remarkable feature of the rendering is the patchy character of the matrix, which in this respect is more distinguished than any other illustration in the entire series.

Locality.—First road-metal quarry below Owharoa.
Formation.—Beeson's Island group.
Remarks.—Though close to the mining district of Owharoa, this and the rocks mined in are very distinctive from each other, yet in the field without careful examination it would hardly be concluded that the rock is a dacite.

No. 246/249.

M.C.—A bluish or greenish-grey dark-coloured rock, with white phenocrysts of felspar; includes finer-grained patches.

U.M.—MATRIX micropœcillitic jagged quartz grains and felspar laths, pseudomorphs in chlorite and carbonates, leucoxene and magnetite granules. Matrix more than half the rock.

PHENOCRYSTS.—*Plagioclase:* Large crystals and complexes beginning to decompose into carbonates; zonal; *r.i.*, above balsam.

Pyroxene: Large crystals and complex growths represented by pseudomorphs in chlorite and carbonates. The chlorite is partly green, partly colourless. Opacite fills the cracks in the pseudomorphs, which has at times a form very suggestive of olivine.

Hornblende: A few resorption pseudomorphs.

Quartz: A few large corroded grains which sometimes form the nucleus of a micropœcillitic patch.

Ilmenite: Passing into sphene.

Pyroxene Hornblende Dacite.

Locality.—Second road-metal quarry below Cumming's, Owharoa district.

Formation.—Beeson's Island group.

Remarks.—This rock is typical of the Beeson's Island group in the Ohinemuri district.

No. 247/258.

M.C.—A dark bluish-grey compact rock, with white felspar phenocrysts.

U.M.—MATRIX: Crowded felspar laths and tables (010), crystal grains of pyroxene, and magnetite lying in stream-lines, immersed in colourless glass, of which, however, there is very little, the crystalline elements occupying nearly the whole of the space. Some quartz grains are present, particularly along streak-like lines. The matrix forms a little more than half the rock.

PHENOCRYSTS.—*Plagioclase* abundant, large crystals, fresh, filled with glass thread inclusions, margin alone remaining clear; in many cases ext. 26°/26° (andesine–labradorite).

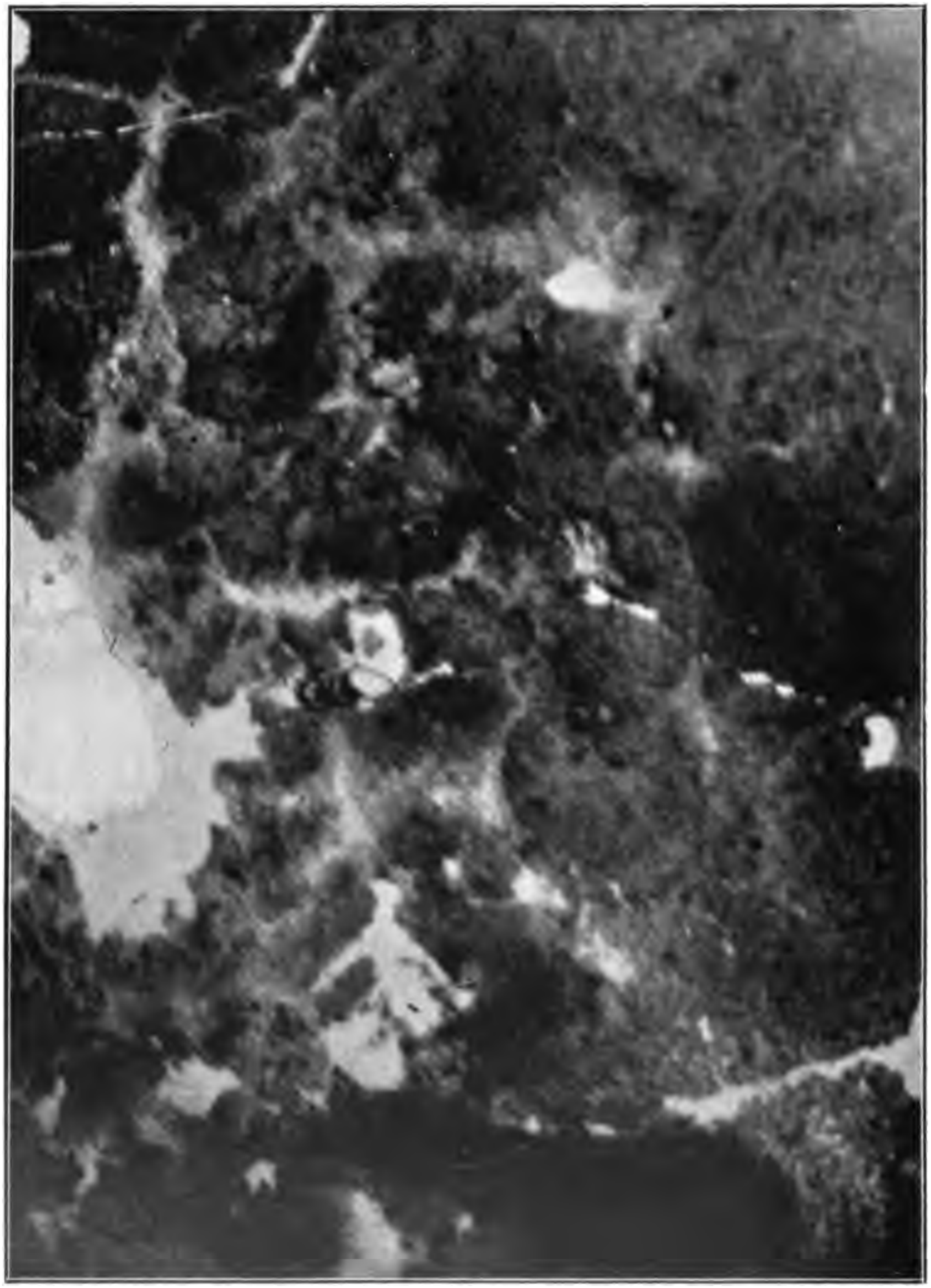
Augite: A few corroded crystals and fragments, faint-green colour.

Hypersthene: Somewhat commoner than augite, large crystals, fresh, marked pleochroism; includes patches of a yellow alterative product, and cavities often with an included magnetite grain.

Quartz: One or two corroded grains.

Magnetite: A very few large grains.

Hypersthene Dacite poor in quartz, or Quartz Hypersthene Andesite.



No. 248/268. SPHERULITIC RHYOLITE. [*To face p.* 35, *Vol. II.*

Locality.—Hills on the coast-line east of Waihi, Waihi district.

Formation.—Kapanga group.

Remarks.—This rock may belong to the Beeson's Island group as developed in the hills south and west of Waihi Beach.

No. 248/268.

M.C.—A rock very largely formed of spherulites.

U.M.—MATRIX: Positive spherulitic material make up the bulk of the rock. Stream-lines well marked by belonites and trichites, the belonites very abundant. Grains of magnetite present.

PHENOCRYSTS.—*Plagioclase:* Corroded crystals common, invaded by the matrix. Albitic twinning; *r.i.*, above balsam; ext., 8°/ 9° (oligoclase–andesine).

Pyroxene: Rare pseudomorphs, torn out in grinding, what remains serpentinous.

Quartz in grains and bi-pyramids.

Spherulitic Rhyolite, with plagioclase.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, lower middle, which in a much-torn slice can scarcely claim to be characteristic of the whole.

Locality.—The west spur of the coast range opposite the Silverton Hills, Waihi district.

Formation.— Acid group of Pliocene age.

Remarks.—This rock forms the range bounding on the east the Waihi part of the Upper Ohinemuri Plain, and overlooks the younger, grey, earthy, and pitchstone pumiceous rhyolite of the plain to the west.

No. 249/292.

M.C.—A cream-white or greyish-white rhyolite, invaded by quartz.

U.M.—MATRIX: Positive spherulitic material and positive spherulites set in a groundwork of quartz mosaic of various degrees of fineness. The quartz mosaic under high magnification is found to consist of quartz and rhombic rectangular and hexagonal plates of felspar; the *r.i.* of the felspar is lower than that of the quartz; in some cases an extinction parallel to one edge was obtained. Many of these felspar crystals are present in each quartz grain of the mosaic.

PHENOCRYSTS occur in the spherulitic matrix.

Plagioclase rare, small crystals, corroded; *r.i.*, below balsam; ext., 7° and 17°, with two cleavages; some after corrosion converted into quartz mosaic.

Quartz: Corroded grains and bi-pyramids, numerous, some very fine examples.

Spherulitic and **Crystalline Granular Rhyolite.**

Illustration.—Slice shows but moderate contrasts, and the negative by means of polarised light does not show the spherulitic structure of the slice. A great number of small opaque dots and some clearer patches alone redeem the reproduction from absolute sameness. Magnification, 60 diameters; area photographed, lower middle part, over which the small opaque spots are more plentiful than in other parts of the slice.

Locality.—The Talisman Extended Claim, Karangahake Mountain, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—This rock constitutes the walls of an auriferous lode which has been prospected and to some extent proved gold-bearing. Apart from the principal leader, there are a multitude of small and minute veins running through the rock in all directions. The rock is highly spherulitic, and can be so determined by aid of a pocket-lens, but neither the negative, print nor reproduction shows this structure distinctly.

No. 250/301.

M.C.—A cream-white rhyolite, invaded by numerous veins of quartz.

U.M.—MATRIX: Positive spherulitic material, chiefly spherulites set in quartz mosaics, and frequently transformed into quartz mosaic either partly or wholly. Small crystals of orthoclase are present in some of the mosaics, but never so numerous nor minute as in the preceding rock. Granules of leucoxene are present.

PHENOCRYSTS.—*Orthoclase:* One or two fresh crystals, but numerous examples in which the felspar is in whole or in part replaced by quartz mosaic.

Quartz: Numerous corroded grains and bi-pyramids.

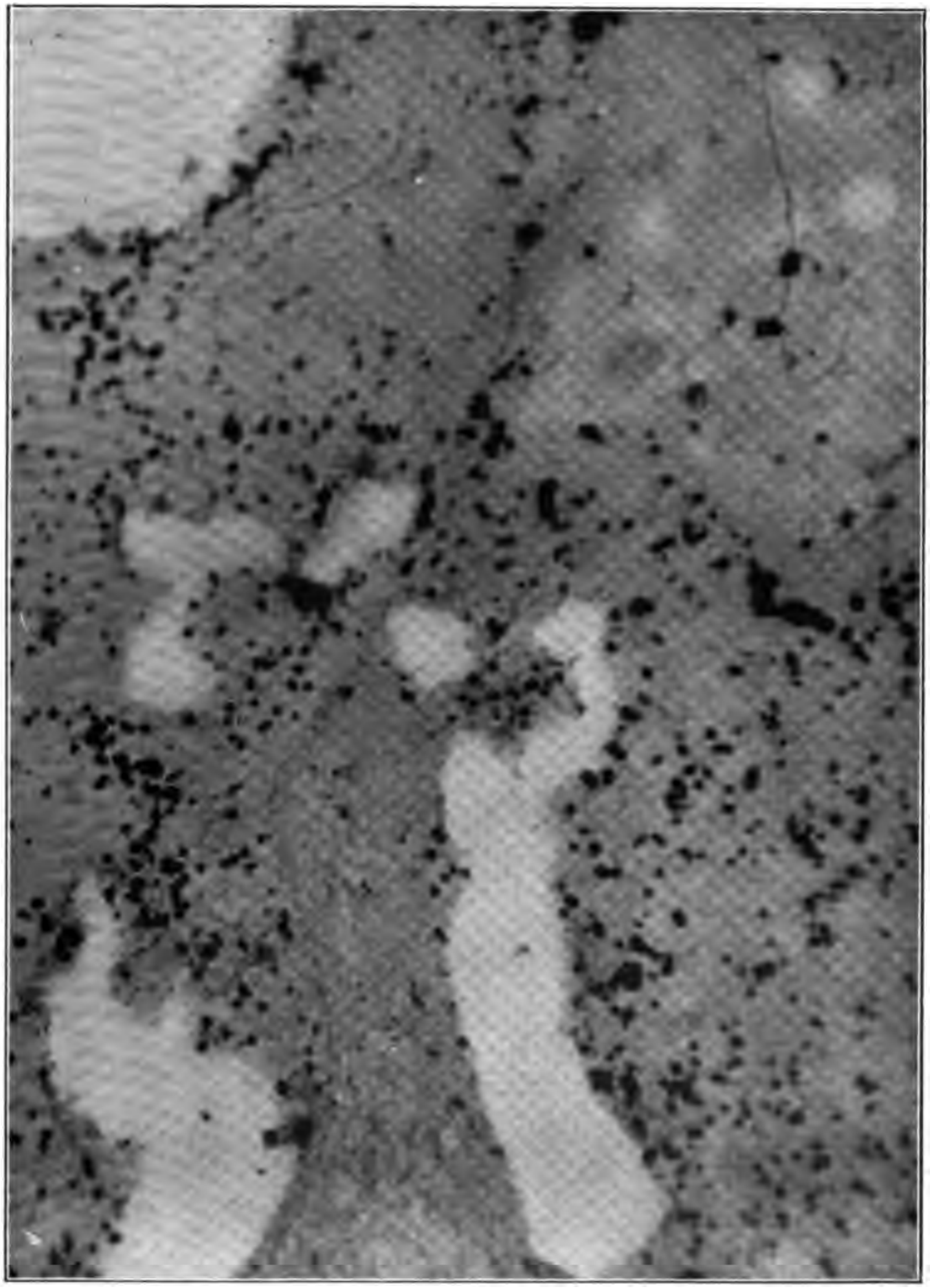
Pyroxene: A few crystals represented by pseudomorphs in quartz mosaic with associated leucoxene.

Leucoxene in plates after ilmenite.

Spherulitic Rhyolite, partly replaced by quartz mosaic.

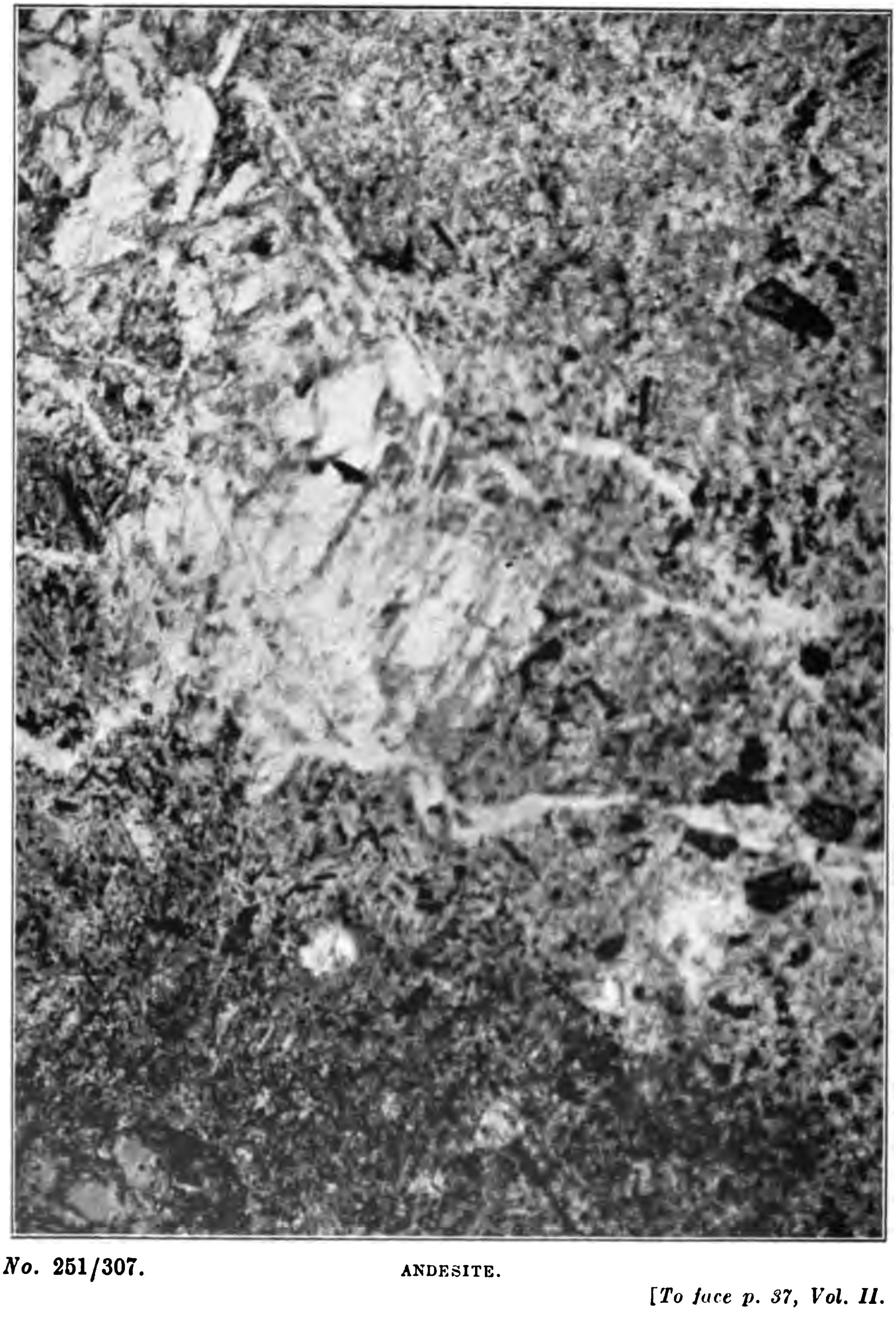
Locality.—The Talisman Extended Gold-mining Claim, Karangahake, Ohinemuri County.

Formation.—Thames-Tokatea group.



No. 249/292. SPHERULITIC AND CRYSTALLINE GRANULAR RHYOLITE.

[*To face p. 36, Vol. II.*



No. 251/307.

ANDESITE.

[*To face p.* 37, *Vol. II.*

Remarks.—This rock specially illustrates the occurrence of auriferous-quartz veins in spherulitic rhyolite. The specimen is larger than usual in order to show the manner in which the larger and smaller quartz veins occur.

No. 251/307.

M.C.—A dark-grey andesic rock, traversed by veins of lighter colour.

U.M.—MATRIX: Minutely granulo-crystalline base, partly consisting of chlorite, long felspar laths in stream-lines, irregular quartz grains, and leucoxene granules. Matrix more than half the rock.

PHENOCRYSTS. — *Plagioclase:* Crystals fairly fresh, frequently broken; ext., 20°/20° to 25°/30° (andesine–labradorite); contain glass-inclusions with bubbles, and crystals of altered pyroxene. Cracks filled with quartz and chlorite.

Pyroxene: Originally abundant in well-defined crystals, some of which are twinned, now represented by pseudomorphs of chlorite, except when replaced by quartz mosaic. Some carbonates also present.

Iron-ores oxidised to leucoxene and other decomposition products.

The rock is internally fractured, and the cracks filled with fragmentary material (derived from the rock itself) and a very irregular mosaic of quartz, with pyrites in places.

Andesite fractured internally and cemented by quartz.

Illustration.—Slice shows moderate contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, middle right, which fairly represents the other parts of the slice. The apparent want of definition is a characteristic of the slice.

Locality.—Immediately east of the columnar dyke opposite the Crown battery, on the road to Karangahake, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—The specimen may have been affected by the intrusion of the columnar dyke, which appears close to where the sample was taken.

No. 252/309.

M.C.—A heavy compact greenish-black andesite, with abundant small phenocrysts of plagioclase and pyroxene.

U.M.—MATRIX: Minutely crystallo-granular; abundant felspar laths, often with forked ends, in stream-lines; chlorite in definite crystals, extinguishing parallel, with well-marked mica-like cleavage in bright colours. Faintly pleochroic granules of magnetite. The minutely crystallo-granular base is probably chlorite, possibly produced by the hydration of a basic glass.

Phenocrysts.—*Plagioclase:* Abundant fresh well-formed crystals and complexes; ext., 22°/24°, 28°/34°; includes hypersthene and its serpentinous decomposition products, also negative crystals with bubbles, and glass; a few are becoming muscovitised.

Hypersthene: Fairly numerous crystals passing into green so-called bastite.

Augite: Subordinate to hypersthene, faintly bluish-green crystals showing synthetic twinning in large forms, fresh, extinguishing up to 42°.

Magnetite: A fair number of large grains without leucoxene borders.

Hypersthene Andesite.

Locality.—Columnar dyke in the bed of the Ohinemuri River at the lower end of Karangahake Township, Ohinemuri County.

Formation.—Dyke in rocks of Thames-Tokatea group.

Remarks.—The dyke whence the specimen was taken is very noticeable in the river-bed at the place indicated, and has been collected from and described or commented on by several writers on the geology and petrography of the district. The similar dark rock from opposite the Crown battery is evidently a north continuation of this dyke (which here has a considerable width, as it appears in the excavations on the opposite bank of the river, at the end of the flume bringing water to the battery), and it is also to be met with farther down the valley, probably in rocks of the Beeson's Island group. The intrusion of this dyke should therefore be regarded as having taken place after the deposition of the Beeson's Island group of volcanic deposits had begun.

No. 253/324.

M.C.—A light-coloured greenish-grey rock, with felspar phenocrysts and pyrites.

U.M.—Matrix micropœcillitic; quartz in dusty irregular grains; felspar, orthoclase laths in stream-lines; chlorite and leucoxene; granules of latter not abundant.

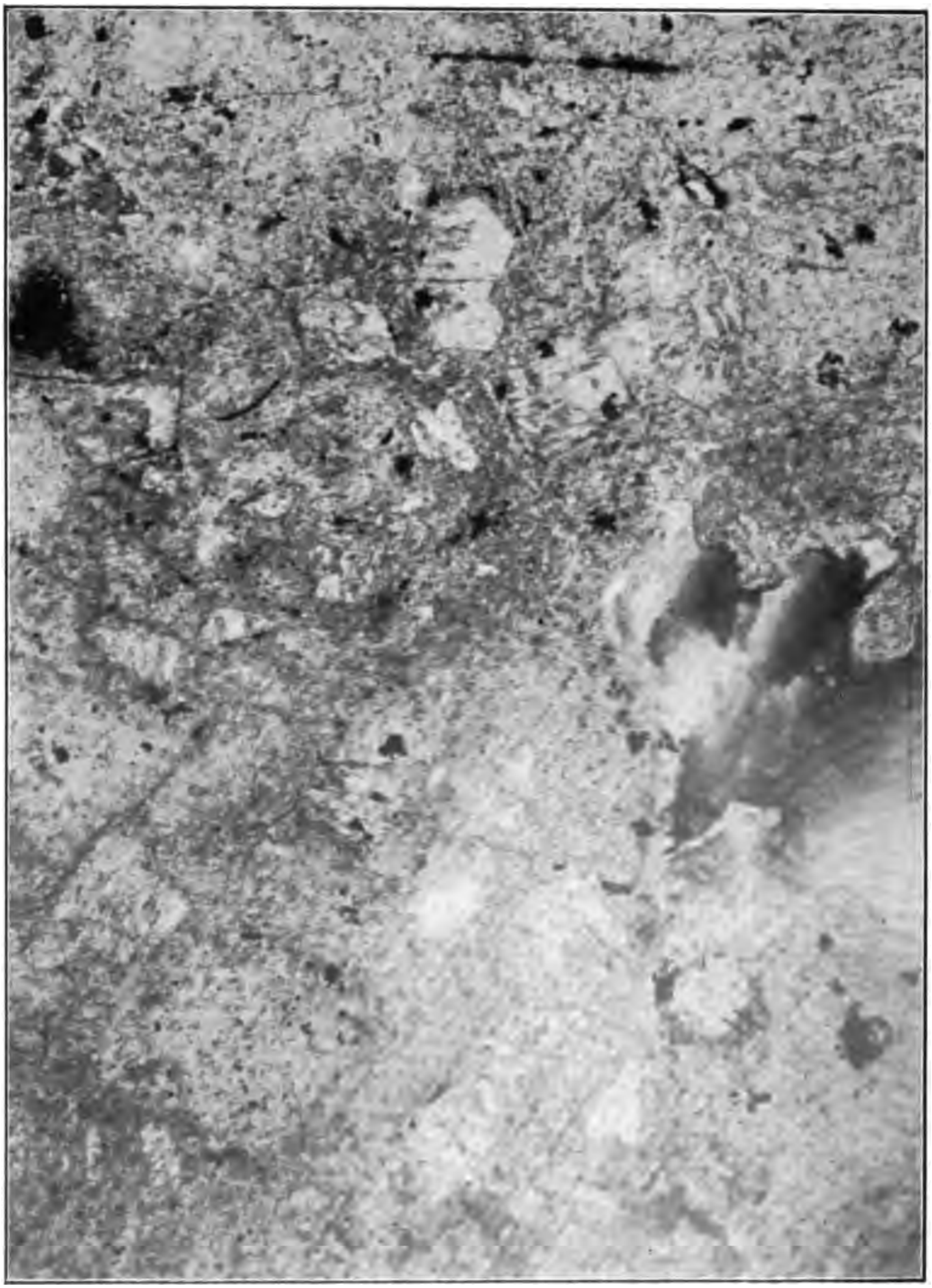
Phenocrysts.—*Orthoclase:* Numerous crystals, complexes, and fragments; *r.i.,* below balsam; ext., 21° with 100, 010 edge. The orthoclase is beginning to be muscovitised, and contains inclusions of chlorite.

Pyroxene not common, but a few pseudomorphs in quartz or chlorite, or both, represent this mineral.

Quartz: No corroded grains, but irregular growths are present, mostly as infillings of irregular cavities; they present a radiate structure in several instances, marked by irregular tubular vapour cavities and characteristic extinction between *x.n.*

Magnetite and *ilmenite* are represented by pseudomorphs in leucoxene, sphene, and quartz.

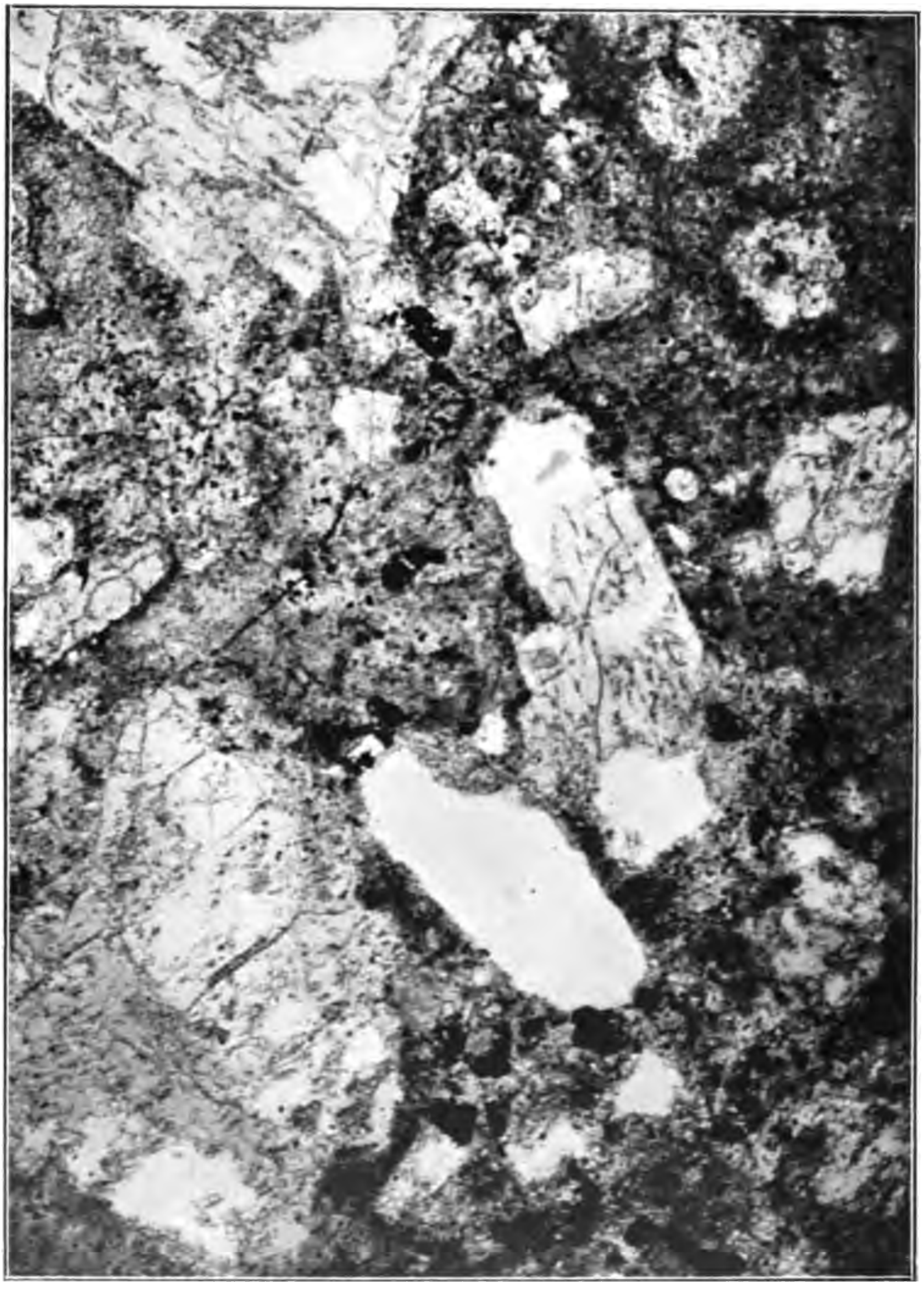
Pyrites is distributed in clusters of small grains.



No. 254/330A. PYROXENE ANDESITE.

[*To face p. 39, Vol. II.*

i.



No. 254/330B. PYROXENE ANDESITE.

[*To face p. 39, Vol. II.*
ii.

Apatite is fairly common as slender prisms included in orthoclase and as larger crystals in the matrix.

Rhyolite, with pyroxene.

Locality.—No. 3 level, Maria lode, Woodstock Mine, Karangahake district.

Formation.—Thames-Tokatea group.

Remarks.—This rock resembles No. 713 from Tararu Creek, in the Thames district, and No. 818 from near the same place. The resemblance, however, does not affect the microscopic characteristics, neither 713 nor 818 being rhyolites.

No. 254/330.

M.C.—A greenish-grey light-coloured rock, with white felspar phenocrysts and chloritic pseudomorphs.

U.M. — MATRIX micropœcillitic; altered felspar laths in stream-lines; quartz in dusty grains, much more abundant in some places than in others, evidently due to secondary infiltration; chlorite. Leucoxene in dendritic granules.

PHENOCRYSTS. — *Plagioclase:* Fairly numerous crystals, converted into carbonates and muscovite.

Orthoclase: Some less altered crystals may be orthoclase.

Pyroxene represented by fairly numerous pseudomorphs in chlorite, carbonates, quartz, and pyrites.

Iron-ores represented by opaque white leucoxene.

Quartz in corroded grains, but banded quartz fills up irregular vesicular cavities.

Apatite: Some.

A **Pyroxene Andesite,** altered partly by weathering, partly by subsequent introduction of quartz.

Illustration.—Slice shows but feeble contrasts.

Photographed by polarised light; magnification, 60 diameters. Areas photographed — (*a*) lower middle, in which secondary quartz or chalcedony is more abundant than in the upper parts of the slice; (*b*) middle right, in which the altered phenocrysts can be distinctly traced.

Locality.—Woodstock Mine, Karangahake district.

Formation.—Thames-Tokatea group.

Remarks.—The specimen is from the west end of the 700 ft. crosscut from the No. 5 level.

No. 255/335.

M.C.—A dark-bluish compact rock, with abundant phenocrysts of felspar, and some chloritic pseudomorphs containing pyrites.

U.M.—MATRIX micropœcillitic, felspar laths in stream-lines, chlorite, carbonates, and leucoxene granules.

PHENOCRYSTS.—*Plagioclase :* Numerous crystals, converted into carbonates and muscovite; cores sometimes fresh and showing synthetic twinning; inclusions of chlorite.

Pyroxene represented by fairly numerous pseudomorphs in quartz, chlorite, and carbonates.

Ilmenite represented by a considerable number of pseudomorphs in leucoxene.

Apatite : Some large crystals.

A thin vein of quartz and chlorite occurs in the slice, but pyrites is absent though present in the hand-specimen.

Altered Pyroxene Andesite.

Locality.—No. 3 level, Woodstock Mine, Karangahake, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—From about 100 ft. back from the face of the drive at date of collection—April, 1897.

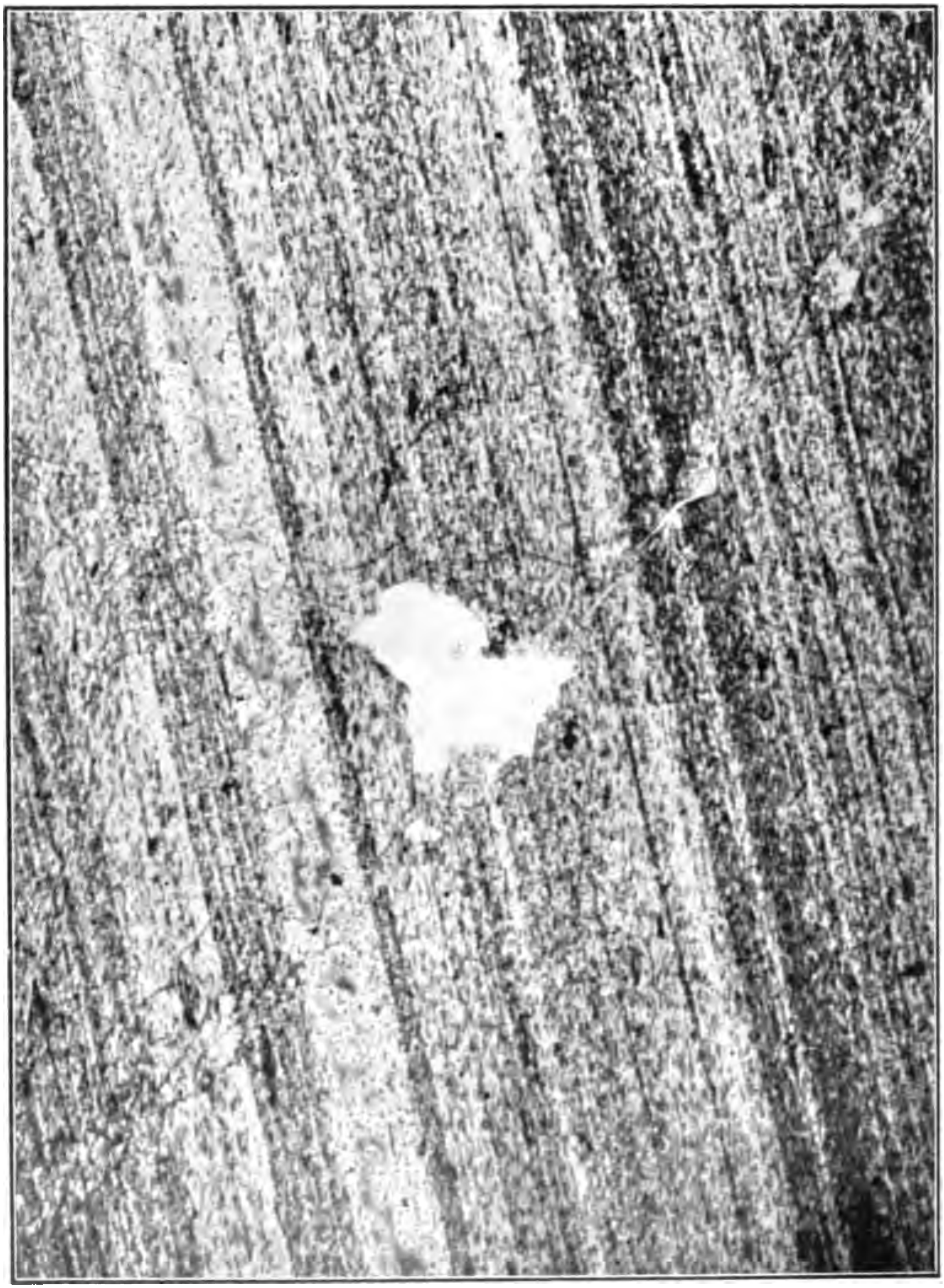
No. 256/338.

M.C.—A light-coloured violet-grey lustreless rock, with white felspar and pyrites.

U.M.—MATRIX : A network of very low double-refracting material, possibly quartz, with pyrites in granules, sometimes very minute and arranged in short straight lines; rare pseudomorphs after felspar laths, leucoxene granules, and chlorite. Threads and patches of irregular grains of quartz capriciously distributed.

PHENOCRYSTS.—*Felspar :* Numerous crystals which rarely present lamellar twinning; *r.i.*, below balsam; traces of the microperthite structure; mica is beginning to appear; some quartz and pyrites are frequently included. The felspar is orthoclase or a soda-bearing orthoclase for the most part.

Pyroxene: Numerous crystals entirely replaced by quartz mosaics and pyrites, the latter so richly scattered in small grains as to mark out the area of the pseudomorphs in the slice. Some of the pseudomorphs may be after hornblende.



No. 257/339. RHYOLITE (?) GLASS.

[*To face p. 41, Vol. II.*

Quartz : A few rounded grains of primary quartz.

Ilmenite : Converted into leucoxene, which is sometimes surrounded by pyrites.

Microperthite Pyroxene Rhyolite.

Locality.—The Golden Fleece Claim, north-west spur of Karangahake Mountain, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—This rock is contiguous to and on the west side of the rib of spherulitic rhyolite that appears on the Talisman Extended Claim, and till the present examination showing the difference the rock was regarded as propylite or "miners' sandstone," usually considered an andesite or a dacite decomposed.

No. 257/339.

M.C.—Black banded glass, weathering along the band.

U.M.—Colourless and brown glass in straight and parallel bands; colourless clear, but densely charged with microliths arranged in stream-lines parallel to the banding; the brown glass finely granular, becoming clear and colourless round the microliths, which are sparingly present in it.

MICROLITHS: Many are rod-like with expanded ends, colourless, and extinguishing up to 45°. Some are twinned; twinning plane at right angles to the length. The twinning can only be observed by means of a quartz wedge, which in twinned crystals shows one end positive and the other negative. Other slender colourless rods are also present, as well as small crystals of plagioclase, which in one instance gave an extinction of 10°/6°, measured from synthetic twin lamella; the *r.i.* was found to be above that of balsam. Trichites are absent. Some green elongated rods, pleochroic, extinguishing up to 9°, are probably hornblende. The specific gravity of the rock is about 2·44, as determined from small fragments.

Rhyolite (?) Glass.

Illustration. — Slice shows good contrast between the glass clear and brown bands.

Photographed by polarised light; magnification, 60 diameters; area photographed, middle part, which fairly represents the rest of the slice, the difference being only in the greater breadth and darker brown of some of the bands.

Locality.—The Upper Ohinemuri Plain, between Waihi and Waikino, Ohinemuri County.

Formation.—Acid group of Pliocene age.

Remarks.—The specimen is small, and has been long exposed to the action of the weather, whereby the even lamination of the alternate thin bands is made to appear, the harder standing out in bold relief from the other. The photo-illustration shows well the general character of the specimen, and at the same time the extreme thinness of some of the laminations.

No. 258/347.

M.C.—A green, compact, fine-grained, fragmental rock, formed of igneous material.

(Overlooked; specimen returned without name or description.)

Locality.—Beach between Tararu Creek and Rocky Point, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—The specimen was collected at the southern end of the beach, and therefore belongs to the higher part of the section exposed along the beach.

No. 259/348.

M.C.—A brownish-grey compact rock, with small phenocrysts of glassy felspar.

U.M.—MATRIX formed chiefly of minute positive spherulitic and axiolitic material, of a brownish colour by transmitted and white by reflected light, owing to its minutely granular character. Between this material colourless minute mosaics. The axiolites determined by stream-lines. Matrix forms chief part of the rock.

PHENOCRYSTS.—*Plagioclase* in fragments and well-formed crystals; *r.i.*, greater than balsam; ext., 28°/ 28°; clear; poor in inclusions, though contained groundmass sometimes present. Apatite crystals included.

Hypersthene: Fragments and crystals; fresh, faint pleochroism; rare.

Augite: A few fragments and crystals.

Magnetite: Several grains, especially associated with pyroxene.

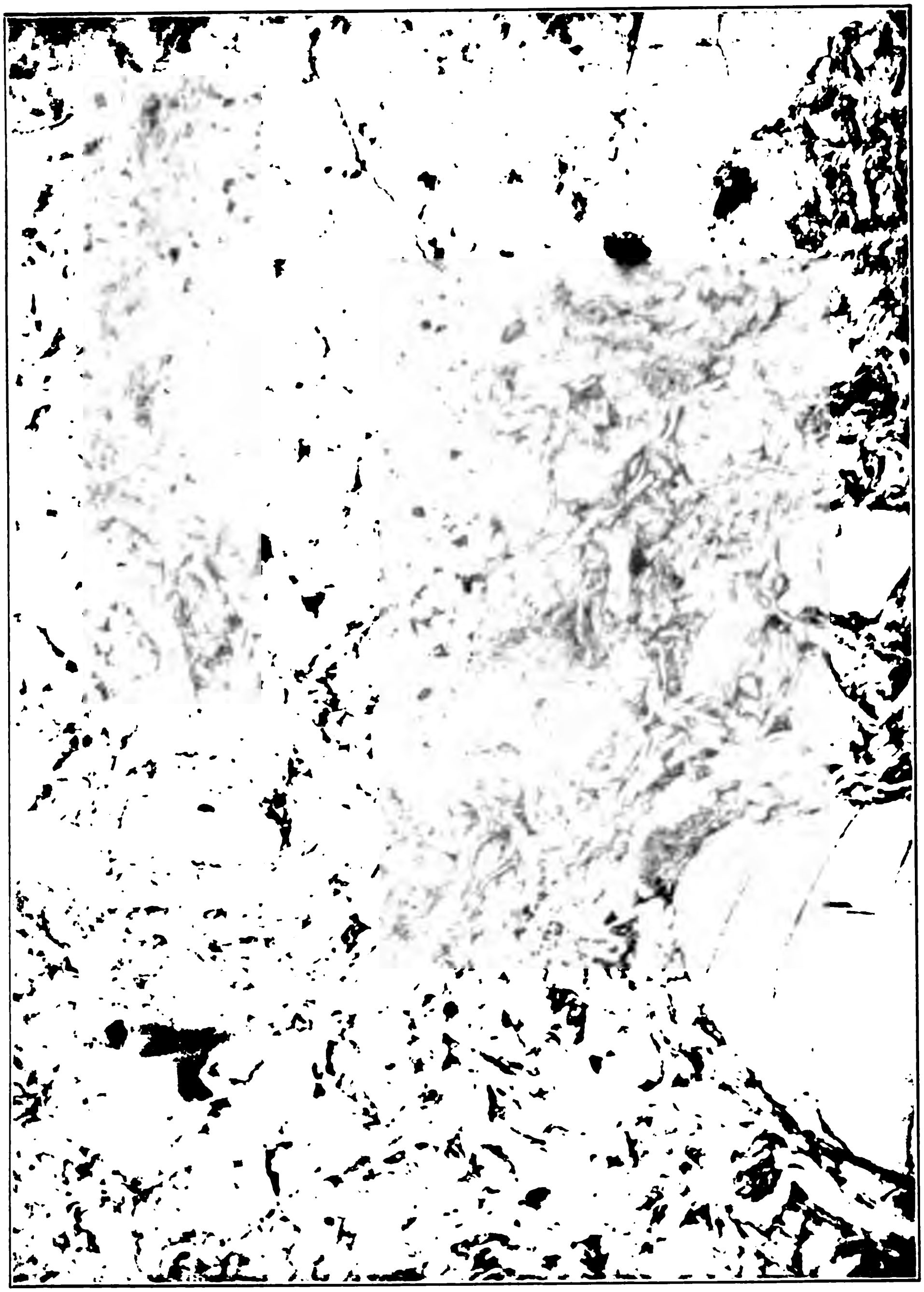
Patches of coarser spherulitic material occur in places.

Xenoliths of andesite are present.

Spherulitic Rhyolite, with plagioclase hypersthene and augite.

Locality.—Quarries at west end of tunnel on Waikino–Waitekauri Water-race, Ohinemuri County.

Formation.—Acid group of Pliocene age.



No. 260/350. VOLCANIC ASH. [*To face p. 43, Vol. II.*

Remarks.—In colour this rock is unlike the dense fine-grained rocks that form intrusions into or lie at the base of the younger series of rhyolites in the Ohinemuri Valley; in other respects the two rocks are much alike, though it is probable that in this the small phenocrysts of glassy felspar are more abundant or more easily detected in the darker matrix.

No. 260/350.

M.C.—A light-grey and green tuff.

U.M.—Consists chiefly of shreds and threads of colourless glass entangled and fused together. Most of the glass is perfectly clear and free from granules, but here and there a fragment is met with which, owing to its minutely granular structure, is brown by transmitted and white by reflected light. Fragments of pumice are included, and fragments and crystals of plagioclase with synthetic twinning and streaked zonal structure; many of the fragments are minute. Some of the felspar is devoid of lamellar twinning and ext. parallel, but has its *r.i.* above that of balsam. Fragments of the groundmass of a flow rock are also present.

Volcanic Ash.

Illustration.—Slice shows but poor contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, middle part, which is characteristic of the whole of the slice.

Locality.—West end of the tunnel nearest the head of the Waitekauri–Waikino Water-race, Ohinemuri County.

Formation.—Acid group of Pliocene age.

Remarks.—This rock, which frequently contains plant-remains and other inclusions foreign to the general composition of an acid rock, rests on a loose deposit of pumice, which alone interposes between it and the andesites and dacites of the adjacent hills bounding the Lower Waitekauri Valley. This rock is thus seemingly near the base of the group of igneous deposits to which it belongs.

No. 261/354.

M.C.—A dark-grey moderately fine-grained crystalline rock.

U.M.—MATRIX reduced to a minimum, and scarcely distinguished from the rest of the rock, differing only in consisting of smaller crystals of felspar with interstitial quartz.

PHENOCRYSTS.—*Plagioclase:* This has lost its freshness; contains carbonates and chlorite, and some quartz, and is broken *in situ*; lamellar twinning; ext., 20°/30° (andesine).

Pyroxene represented by pseudomorphs in chlorite or carbonates, or both, with associated leucoxene.

Iron-ores : Some fringed with leucoxene.

Some irregular areas filled with radio-fibrous chlorite and quartz are probably filled in vesicules.

Plagioclase Pyroxene Rock: Phanero-crystalline Andesite.

Locality.—Upper part of Karaka Creek, Thames Goldfield, Thames County.

Formation.—Thames-Tokatea group.

Remarks.—This rock is from near the eastern limit of the productive part of the goldfield, but is undoubtedly a rock of the Thames-Tokatea group. Further east rocks of the Beeson's Island group make their appearance.

No. 262/367.

M.C. — A greyish-black compact rock, porphyritic, with felspar and pyroxene.

U.M. — MATRIX: Hyalopilitic, long plagioclase laths and rectangles crowded together, and with colourless interstitial glass, arranged in streamlines; contains many chips of plagioclase and pyroxene crystals, also very fine granules of magnetite.

PHENOCRYSTS. —*Plagioclase :* Crystals, clusters, and fragments having zonal and irregular growths; some almost free from inclusions, others almost filled with fibres of glass and margin alone clear. Some include hypersthene, also apatite and magnetite. Ext., 23°/ 28°, 28°/ 34° (andesine–labradorite).

Augite : Fairly numerous crystals and fragments, faint bluish-green colour; ext., up to 44°; includes magnetite.

Hypersthene : Fresh, some large crystals and fragmemts, faint pleochroism; includes magnetite.

Magnetite : Fairly numerous grains.

Hyalopilitic Hypersthene Andesite.

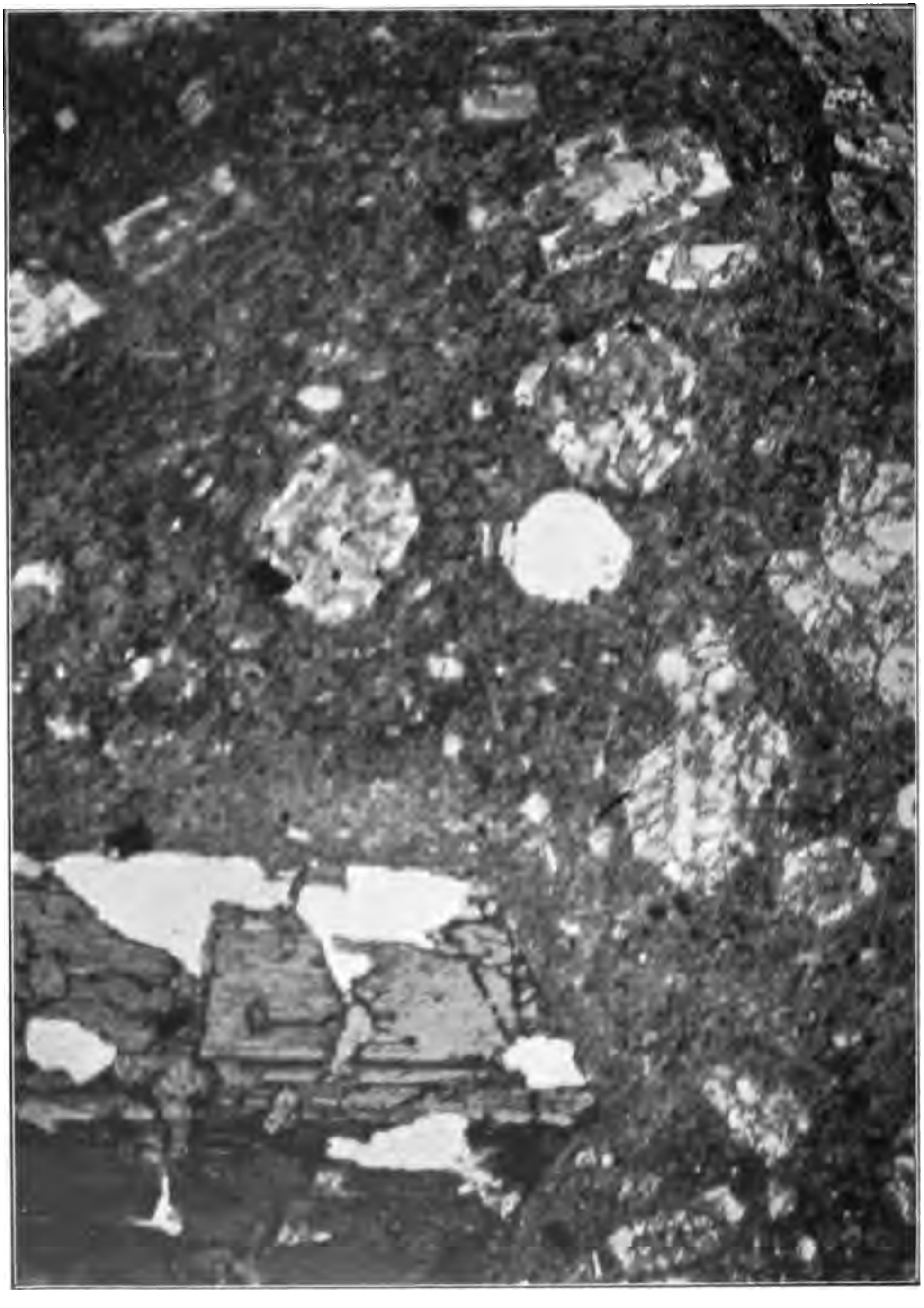
Locality.—East side of the crossing of the Ohinemuri River, on the road from Waihi to Whangamata, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This rock, though at a considerable height, is surrounded by rhyolite; to the east on higher ground, and to the west in the low grounds.

No. 263/380.

M.C. — Light greenish-grey lustreless rock; phenocrysts, felspar, and chlorite pseudomorphs. A quartz vein traverses the rock, and pyrites is present.



No. 263/380. ALTERED HYPERSTHENE ANDESITE.

[To face p. 45, Vol. II.

U.M.—MATRIX about half the rock. Micropœcillitic in places only, elsewhere microgranular crystalline, with abundant minute felspar laths; chlorite and leucoxene granules. Flow-structure.

PHENOCRYSTS.—*Plagioclase:* Abundant crystals, complexes, and fragments; fairly fresh, muscovitisation commencing; ext., 23°/26°.

Augite: Colourless or nearly so, not abundant, some very small grains included in plagioclase are quite fresh.

Hypersthene represented by pseudomorphs in quartz and chlorite, usually small, but numerous.

Ilmenite: Plates converted into leucoxene.

Altered Hypersthene Andesite.

Illustration.—Slice shows good contrasts, chiefly through the presence of an absolutely opaque mineral, without which the contrasts would be feeble.

Photographed by polarised light; magnification, 60 diameters; area photographed, middle part, which is fairly characteristic of the rest of the slice.

Locality.—Upper tunnel of the Woodstock Mine, Karangahake district, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—The specimen is from the higher workings of the mine, near the Talisman boundary. The Talisman Mine occupies the higher part of the mountain-slope; the Woodstock, the lower part to the bottom of the gorge of the Waitawheta.

No. 264/382.

M.C.—A pale-green earthy rock, with small phenocrysts of felspar and scattered pyrites.

U.M.—MATRIX: Felspar laths in stream-lines, extinguish for most part parallel; chlorite as abundant intervening material; leucoxene grains and quartz.

PHENOCRYSTS.—*Orthoclase:* Numerous well-formed crystals. Sometimes twinned on the Carlsbad plan, containing numerous small crystals of pyrites, and sometimes chlorite and quartz; mica is developed in some.

Albite: A few crystals show synthetic twinning; ext. at 20°, and have *r.i.* below balsam.

Pyroxene represented by pseudomorphs in chlorite, or chlorite and quartz.

Ilmenite: Numerous plates associated with leucoxene.

Orthoclase pyroxene rock, impregnated with pyrites and quartz.

Pyroxene Trachyte.

The whole of the quartz is probably secondary.

Locality.—No. 6 level, Talisman Mine, Karangahake, Ohinemuri County.
Formation.—Thames-Tokatea group.
Remarks.—This rock is underlain by No. 380, which is an andesite.

No. 265/394.

M.C.—A greyish-white rhyolite-like rock, with long lenticular streaks of black glass.

U.M.—MATRIX: *White portion*—Glass, colourless-clear to faintly-brown, ultra-microscopic granular, drawn out and broken into forms usually taken as distinctive of tuff. The interstices between these are filled with a scaly granular material, which is isotropic, brownish by transmitted and white by reflected light.

Black portion—Colourless-clear to brownish ultra-microscopic granular glass, with slender thread-like vapour cavities running in stream-lines, and perlitic structure. The stream-lines of these fragments may correspond with those of the rock in general or not; sometimes they are directed at right angles to the general flow, but the long axis of the whole fragment runs even then with the stream-lines.

PHENOCRYSTS.—These are present both in the white and black fragments.

Plagioclase: Well-formed crystals and fragments, chiefly fragments in the white portion; sometimes zonal; synthetic twinning; ext., 12°/19°, 19°/20° (oligoclase–andesine); *r.i.* in one instance greater than that of balsam.

Pyroxene: One well-formed crystal represented by a pseudomorph in chlorite, with associated magnetite, also a few rare fragments.

Biotite: A few worn crystals in process of alteration and corrosion; pleochroism deep olive-green, almost black / straw-yellow.

Quartz: Numerous fragments and corroded grains.

Xenoliths: A few small foreign fragments are included, as follows: Fragments of positive spherulitic growths, groundmass of an andesic appearance, brown glass with rectangles of plagioclase, chloritic pseudomorphs after pyroxene, magnetic grains, groundmass consisting of long felspar laths with a tendency to radiate growth, interstitial serpentine after pyroxene, and interstitial quartz.

If, as the field evidence seems to suggest, and as the general appearance of the hand-specimens also suggest, this is a flow rock, then the form of the shreds of glass can no longer be regarded as distinctive of a tuff. Doubts have already in other cases been thrown on conclusions drawn from this character.

Rhyolite.

Locality.—Waterfall Creek, left bank of the Ohinemuri, between Waikino and Owharoa, Ohinemuri County.

Formation.—Acid group of Pliocene age.

Remarks.—This remarkable rock has been variously regarded as a tuff or a flow rock. It is a very characteristic rock of the Upper Ohinemuri Plain between Waikino and Waihi, and is practically the same in character and appearance at both the places mentioned. Near Waikino it forms a thick deposit, which may be estimated at 200 ft., more or less, and as seen in the excavations of the new road to Waihi it has a uniform character as respects its composition, and the manner in which the rock is cut by joint planes is well shown in the photo-illustration facing page 106 of Vol. i. On the banks of the Ohinemuri, near the Silverton battery, the rock has the same character, and here it has been quarried for road-making purposes in and near the Township of Waihi. In the locality of the specimen above described the rock contains more than the ordinary amount of glassy pitchstone, but otherwise maintains the general characteristics of the rock in all the localities where it is naturally or artificially exposed.

No. 266/400.

M.C. — Greenish-grey compact rock, porphyritic, with greenish-white felspar.

U.M.—MATRIX: Felspar laths, minute, in stream-lines; chlorite interstitial; quartz in irregular grains and as quartz "globulaire"; leucoxene granules. Matrix at least half the rock.

PHENOCRYSTS. — *Plagioclase* abundant in well-formed large crystals and complexes, much altered by conversion into carbonates and sericite; nests of quartz also present in them. When fresh, lamellar twinning obvious.

Pyroxene (probably including hypersthene) in numerous pseudomorphs, consisting of chlorite, quartz, carbonates, and associated leucoxene after ilmenite. Many of the pseudomorphs consist almost wholly of quartz mosaic.

Ilmenite rather abundantly represented by leucoxene.

Altered Andesite.

Locality.—New Zealand Crown Mines, Karangahake district.

Formation.—Thames-Tokatea group.

Remarks.—From the middle part of the east crosscut in the lower level of the mine at time of collection—April, 1898.

No. 267/401.

M.C.—Greenish-grey rock, porphyritic, with white felspar.

U.M. — MATRIX crowded with minute felspar rods in stream-lines; sporadic irregular grains of quartz; interstitial chlorite; grains of leucoxene. Matrix at least half the rock.

Phenocrysts. — Felspar: Numerous large well-formed crystals highly micacised; very slight trace of carbonates.

Pyroxene represented by fairly numerous pseudomorphs in chlorite, with some quartz.

Ilmenite represented by a fair number of leucoxene pseudomorphs.

Altered Felspar Pyroxene Flow Rock; possibly an altered andesite.

Locality.—Low-level crosscut, New Zealand Crown Mines, Karangahake, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—This rock in the mode of its felspars resembles some of the Beeson's Island rocks, more especially those found on the north side of the upper part of Manaia Harbour (No. 3424).

The manager of the Crown Mines states that this rock had considerably altered in appearance between the driving of the lower level and the time when the specimen was collected. Iron-stains had been formed on the walls of the drive, and the felspars appeared more milky at the surface than where the rock showed them in fresh-fractured surfaces.

No. 268/402.

M.C.—Very light-coloured greenish-grey rock, porphyritic, with white felspars and pseudomorphs after pyroxene.

U.M.—MATRIX: Islands of matrix composed of minute felspar laths or their pseudomorphs immersed in chlorite, with scattered granules of leucoxene; these islands set in a minute quartz mosaic, with interlocking quartz grains, containing remains of felspar. Matrix more than half the rock.

PHENOCRYSTS.—*Felspar* fairly numerous well-formed crystals, represented by pseudomorphs in muscovite, with chlorite and quartz,

Pyroxene represented by numerous pseudomorphs, chiefly in chlorite and quartz.

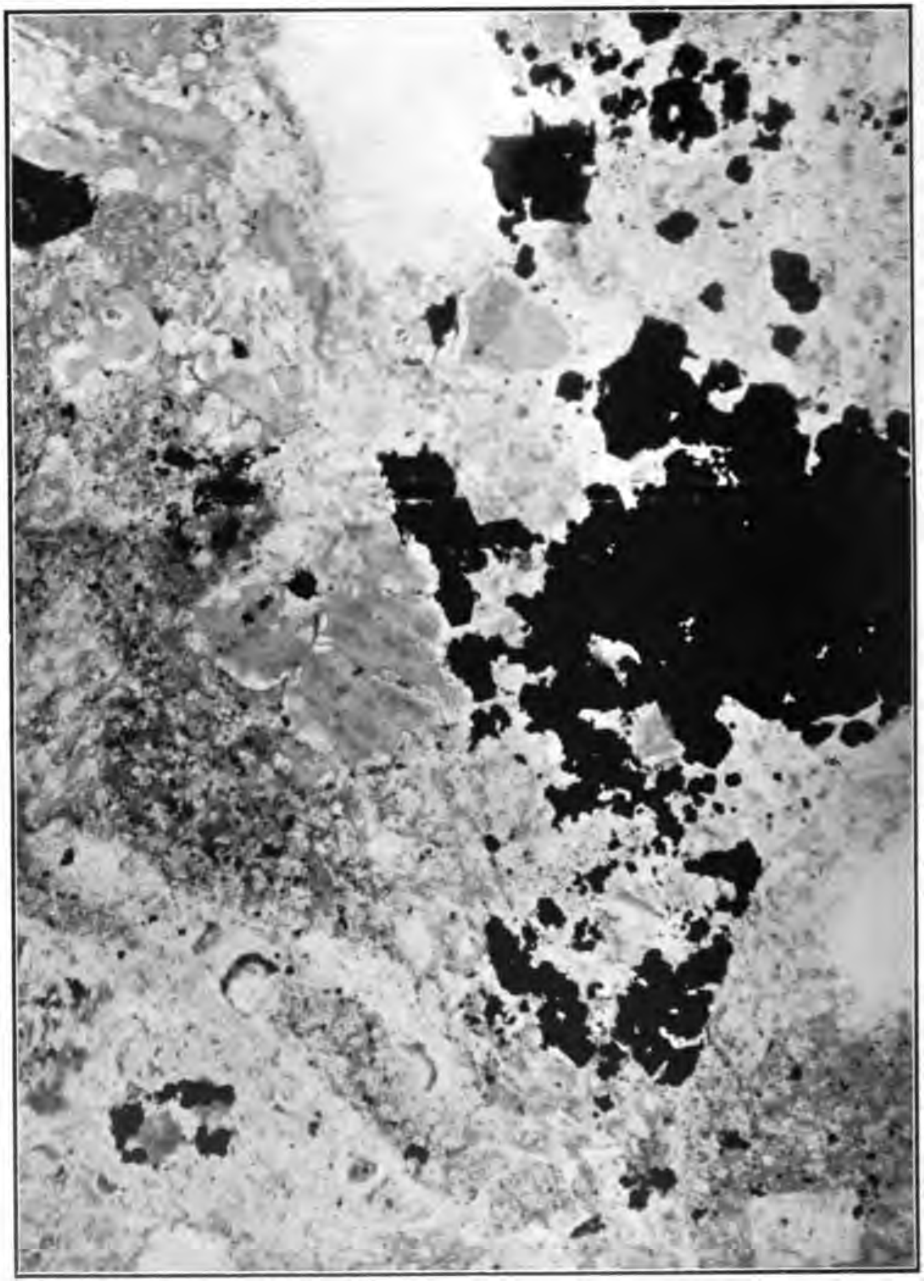
Ilmenite represented by numerous pseudomorphs in leucoxene.

Altered Felspar Pyroxene Flow Rock; possibly an altered andesite.

Locality.—New Zealand Crown Mines, Karangahake, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—The specimens Nos. 400, 401, and 402 are of interest as being from the greatest mine-depth that had been attained, at time of collection, by any mine in the Karangahake district.



No. 269/406. ALTERED ANDESITE.

[To face p. 49, Vol. II.

No. 269/406.

M.C.—Greenish-grey rock, with phenocrysts of white felspar; veins and nests of calcite, with quartz and pyrites.

U.M.—MATRIX as in preceding rock.

PHENOCRYSTS.—Felspar fairly numerous large crystals, converted into carbonates, muscovite, and chlorite.

Pyroxene represented by pseudomorphs in chlorite and quartz grains and mosaics. Chlorite, marked pleochroism, green / straw-yellow, polarises in yellow tints, sharp mica-like cleavage. In some cases the quartz has taken not the mosaic, but a spherulitic form, giving a well-defined cross between *x.n.*

Ilmenite and *magnetite* represented by leucoxene.

Apatite: A few large colourless crystals.

An irregular vesicle filled with plumose quartz, concentric shelled spherules of calcite, and pyrites grains are present.

Altered Felspar Pyroxene Flow Rock; possibly an altered andesite.

Illustration.—Slice shows medium contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, upper middle, which, owing to the slice being varied, is not characteristic of the other parts.

Locality.—From the east crosscut, lower level, New Zealand Crown Mines, Karangahake, Ohinemuri County.

Formation.—Thames-Tokatea group.

Remarks.—The New Zealand Crown and the Woodstock Mines are adjacent to each other, and the lower rocks in each may be regarded as the same or similar. In the Woodstock Mine no workings were, at the time of collecting, as deep as the lower level in the Crown Mines.

No. 270/418.

M.C.—Greenish or greyish-white earthy rock, with altered phenocrysts.

U.M.—MATRIX consists of felspar laths or their pseudomorphs in stream-lines, irregular quartz grains, minutely granular polarising material, which may be some form of mica or kaolin, and granules of leucoxene. Matrix somewhat more than half the rock.

PHENOCRYSTS.—*Felspar:* Well-formed large crystals, not very numerous, completely altered into kaolin, mica, and some carbonates, but the carbonates are subordinate.

Pyroxene: No certain evidence that pyroxene was present. There are no sections having the characteristic outlines of pyroxene, and the mineral changes have been so great that nothing remains to distinguish between pyroxene and felspar pseudomorphs; some of the pseudomorphs consisting chiefly of carbonates may have been pyroxene.

Ilmenite represented by pseudomorphs in leucoxene.

Apatite : Some.

Small cubes of *pyrites* generally distributed.

An irregular vesicle or two present, filled with carbonates.

Indeterminate; a flow rock, possibly andesite.

Locality.—Waitekauri Cross Mine, Waitekauri Valley, Ohinemuri County.
Formation.—Kapanga group.
Remarks.—This rock and the rocks of the same horizon in the mine abound in calcite, and in this respect there is a close resemblance to the rocks of the Kapanga group in the typical locality at Coromandel.

No. 271/420.

M.C.—Black basalt-like rock, with phenocrysts of felspar, pyroxene, and quartz.

U.M.—MATRIX: Phanero-crystalline, crowded with plagioclase laths, twinned once or oftener, in stream lines; interstitial quartz, crystals of augite, and hypersthene. Granules of magnetite.

PHENOCRYSTS. — *Oligoclase :* Large crystals, clusters, and fragments; *r.i.*, above balsam; ext., 12°/17°; 20°/21° (andesine). Inclusions pyroxene, chlorite, apatite, opacite; negative crystals with glass, in one case enclosing a spherule and within this again a crystal. Inclusions generally sporadic, only in rare cases a border fibrous with glass ; some inclusions zonal.

Augite : Numerous small yellowish-brown almost colourless crystals.

Hypersthene passing into bastite, some fresh, with faint pleochroism.

Magnetite and *ilmenite* fresh.

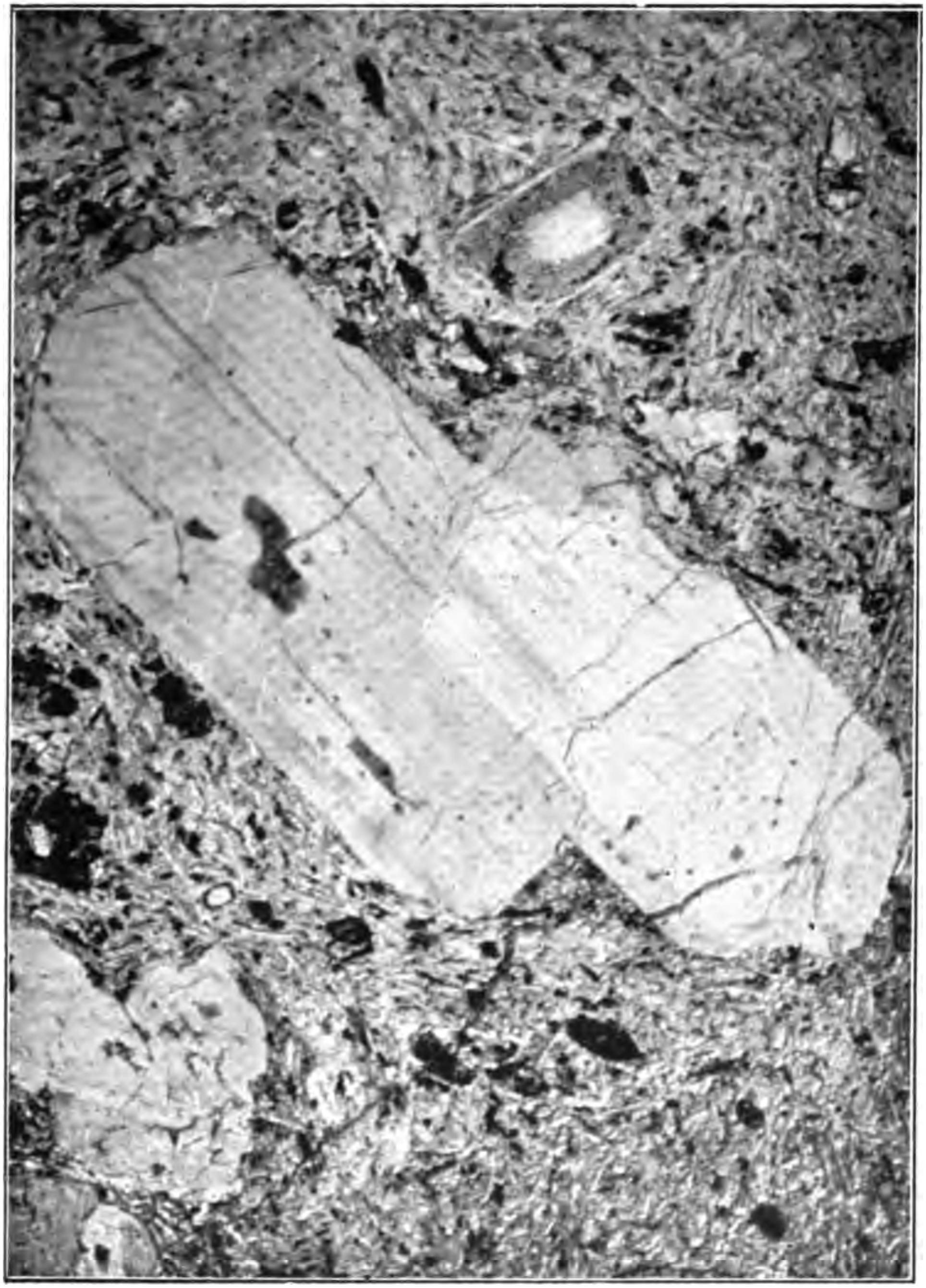
Quartz : A few grains corroded by the matrix; one contains a crystal of augite largely converted into chlorite, two large negative crystals of colourless glass including a dark granular spherule, and plates of ilmenite.

Hornblende : A few crystals represented by resorption products.

The presence of quartz in corroded grains should make this rock a dacite; the quartz is undoubtedly original.

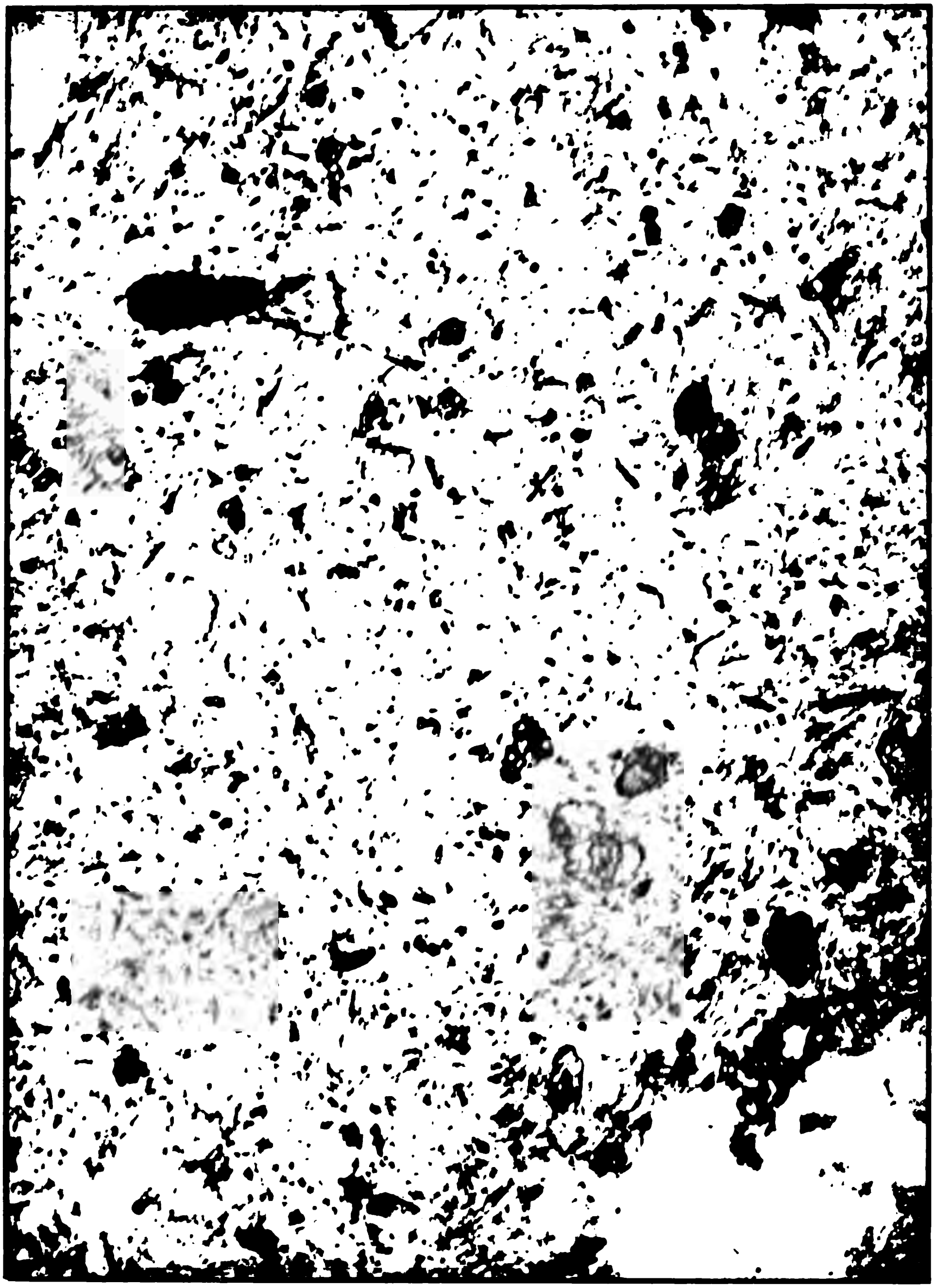
Black Quartz Hypersthene Andesite, with hornblende.

Illustration.—Slice shows good contrasts.
Photographed by polarised light; magnification, 60 diameters; area photographed, lower middle part.



No. 271/420. **BLACK QUARTZ HYPERSTHENE ANDESITE**

[*To face p. 50, Vol. II.*



No. 272/422. BLACK QUARTZ HYPERSTHENE ANDESITE.

[*To face p. 51, Vol. II.*

Locality.—Waitekauri Cross Mine, Waitekauri Valley, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This and specimen No. 418 form the characteristic rocks of the mine whence they come. The present rock as a dark basalt-like rock is represented further down the valley, and the lighter grey or greenish rocks of the upper part of the Waitekauri Valley seem to be separated from the dacites near the township by a band of intensely dark rocks that stretch from west to east across the valley.

No. 272/422.

M.C.—Black basaltic-looking rock, with large phenocrysts of felspar and some quartz grains.

U.M.—MATRIX wholly crystalline, plagioclase laths crowded in stream-lines, interstitial quartz, crystals of augite, hypersthene, and pseudomorphs of chlorite. Granules of magnetite.

PHENOCRYSTS.—*Plagioclase:* Ext. 28°/30° (labradorite). The phenocrysts as well as the matrix resemble those of the preceding rock, but the hornblende resorption products are perhaps more abundant in this. The quartz grains in the present rock may be slightly more numerous.

Black Quartz Hypersthene Andesite, with hornblende.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, middle part. There are several large phenocrysts in the slice, none of which are represented in the reproduction, which is thus not characteristic of the slice.

Locality.—Upper part of the water-race above Waitekauri Township, Waitekauri district.

Formation.—Kapanga group.

Remarks.—This rock, while it resembles the dark rocks in the Waitekauri Cross Mine (compare with specimen No. 420), also resembles closely the dark rocks of the Waihi Consols and Waihi South Mines west of Martha Hill at Waihi, and the rocks in the one locality being determined as belonging to the Kapanga group, the close resemblance favours the conclusion that in the other locality the rocks are of the same age.

No. 273/423.

M.C.—Black compact rock, with hackly fracture and small phenocrysts.

U.M.—MATRIX micropœcillitic, more so in some places than others, crowded with plagioclase laths in stream-lines, chlorite pseudomorphs, and magnetite granules.

PHENOCRYSTS.—*Plagioclase* abundant, large crystals and complexes, zonal; ext., 28° / 33°, 30° / 31° (labradorite); exterior generally fresh; central portion frequently transformed into minutely granular material and mica. Glomeruli. Porphyritic groups of plagioclase and pyroxene in pseudomorphs are common.

Pyroxene: Abundant pseudomorphs in green bastite, probably representing both hypersthene and augite.

Ilmenite: Fresh corroded plates.

Apatite: Fairly numerous and large crystals, with discontinuous longitudinal striation produced by black linear inclusions.

Micropœcillitic Andesite.

Locality.—Upper part of the water-race above Waitekauri Township, Waitekauri Valley, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This is probably identical, or nearly so, with specimen No. 422, which comes from near the same place; but this specimen (No. 423) megascopically so closely resembles No. 494, from the Waihi Consols Mine, that for comparison with the latter it was included in the collections forwarded to England.

No. 274/424.

M.C.—Greenish rock, with large white felspar phenocrysts.

U.M.—MATRIX transformed by decomposition; no traces survive of felspar microliths; irregular dusty quartz grains set in a minutely granular polarising material, with some chlorite pseudomorphs and abundant granules of leucoxene, are all that can be seen.

PHENOCRYSTS.—*Felspar:* Pseudomorphs after well-formed crystals converted into muscovite; traces of synthetic twinning survive in some and give extinction 9°/ 16°.

Pyroxene: Completely altered into green chlorite (pennine) and quartz, which occurs in grains or bands running parallel with the long axis.

Quartz: Several rounded grains and a bi-pyramid were observed, and more may have been present, but torn out in grinding the section.

Ilmenite: Converted into leucoxene.

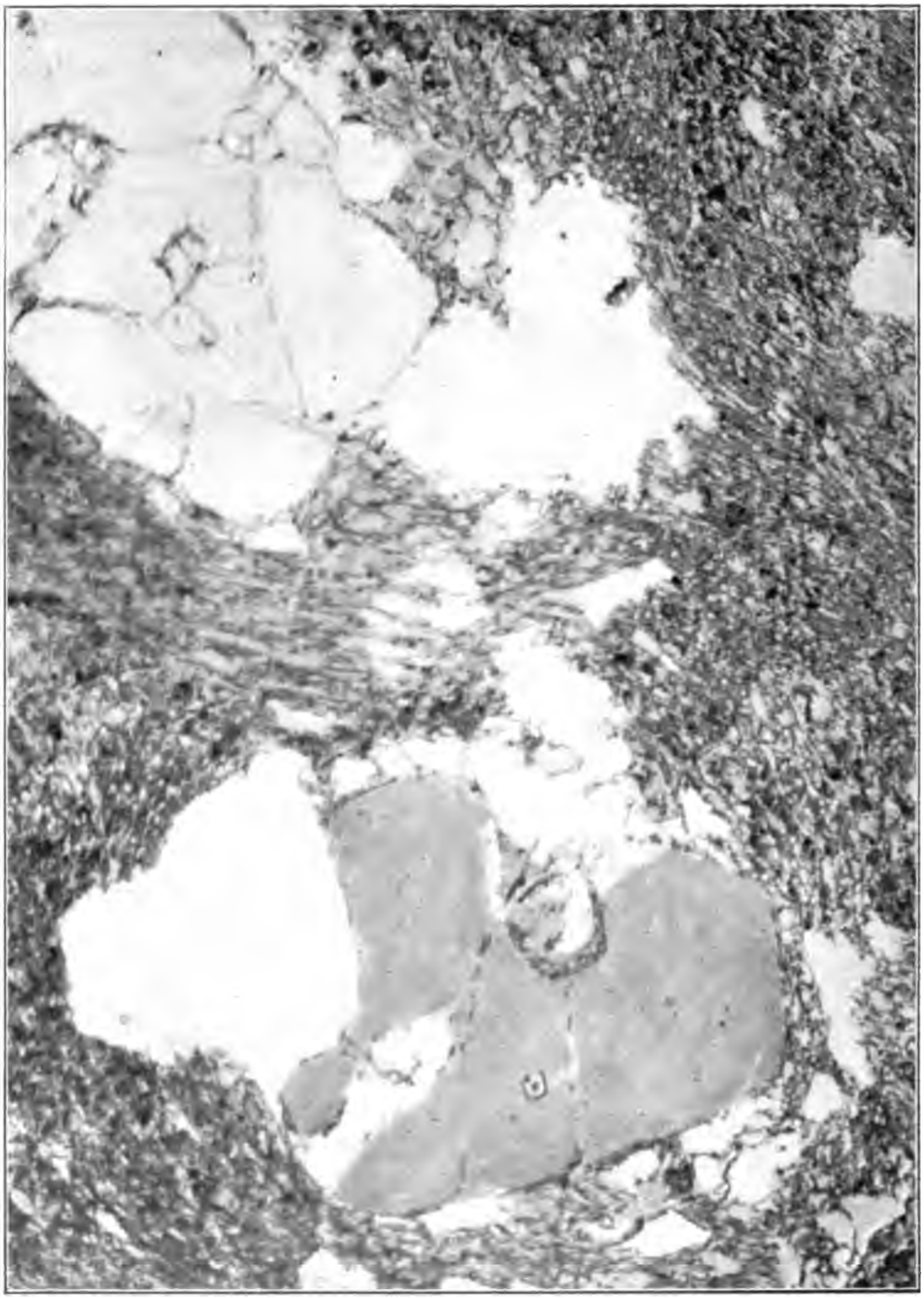
Altered Dacite.

Locality.—Upper part of Maratoto Creek, Hikutaia Valley, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—The specimen was taken from near the saddle leading into the Waitekauri Valley. The sample collected was small, but the rocks of this district are totally unlike the andesic rocks further down the valley, which belong to the Beeson's Island group, and this distinctiveness may in part be due to the intrusive rhyolites that appear at no great distance in the upper part of the valley of the main source of the Hikutaia River.

No. 275/441.



No. 275/441. PUMICE.

[To face p. 53, Vol. II.

No. 275/441.

M.C.—Pumice.

U.M.—Almost colourless glass, with long tubular vesicles drawn out in stream-lines, but becoming rounded, more or less spherical in places. A doubly refracting material, transparent and colourless, runs parallel in threads of similar dimensions to those of the glass, and extinguishes parallel to its length. The rounding of the vesicles frequently takes place on the sheltered side of a phenocryst.

PHENOCRYSTS.—*Plagioclase:* A few fresh crystals, more or less corroded, with synthetic twinning; *r.i.*, above balsam; ext., 9°/10° (oligoclase–andesine).

Quartz in corroded fragments, not abundant, some containing negative crystals of glass.

At the margin of the slice is a small area showing "tuff" structure.

Pumice.

Illustration.—Slice shows fair contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, middle part, which is characteristic of the other parts of the slice.

Locality.—Waikino–Waihi (new) Road, half a mile above the junction of the Waitekauri with the Ohinemuri River, Ohinemuri County.

Formation.—Acid group of Pliocene age.

Remarks.—The specimen represents the larger of the inclusions of pumice that appear abundantly in the Wilsonite of this part of the Upper Ohinemuri Plain. Nearer Waikino and more towards Waihi pumice is much less common in, or apparent as forming part of, the Wilsonite. At this particular place the cliffs along the road have the appearance of a moderately coarse pumiceous breccia.

No. 276/444.

M.C.—White earthy rock, too decomposed to show phenocrysts if present.

U.M.—MATRIX between *x.n.* minutely granular (with kaolin or mica scales?), irregular quartz grains, an occasional indication of a felspar microlith, and abundant minute granules of leucoxene.

PHENOCRYSTS.—*Felspar* represented by pseudomorphs retaining crystal outlines, composed of mica and quartz and occasionally a little felspar. The species is indeterminable.

Pyroxene represented by colourless chlorite polarising in very low tints.

Quartz is also present, and leucoxene.

Ilmenite represented by leucoxene.

Pyrites: A little.

Pyroxene felspar rock (not propylite by any manner of means).

AN Altered Andesite, or Pyroxene Rhyolite.

Locality.—The upper level of the Waihi-Silverton Mine, Silverton Hills, Waihi, Ohinemuri County.
Formation.—Kapanga group.
Remarks.—A great bulk of the rocks in the vicinity of the reefs in the Silverton Hills is of a similar character.
As a light-grey evidently altered or decomposed rock, this and similar rocks in the district are often spoken of as "propylite," and in describing the rock for identification purposes the above specimen was referred to as propylite(?), and hence the remark by Professor Sollas, "Not propylite by any manner of means."

No. 277/445.

M.C.—Greyish-white, decomposed rock, containing pyrites.

U.M.—MATRIX granular polarising material, irregular quartz veins, muscovitised remains of felspar laths, scattered pyrites, and leucoxene.

PHENOCRYSTS.—*Plagioclase:* Large crystals and fragments in various stages of decomposition; when original material present it is frequently twinned, and gives extinction 17°/18°, 15°/24° (andesine); when not twinned it sometimes extinguishes like orthoclase with indications of microperthite structure. Micacisation is the chief change. There is not much carbonate.

Pyroxene is represented by pseudomorphs retaining original outlines in colourless chlorite and (?)serpentine. Apatite is included.

Ilmenite is represented by leucoxene.

Pyrites is abundant.

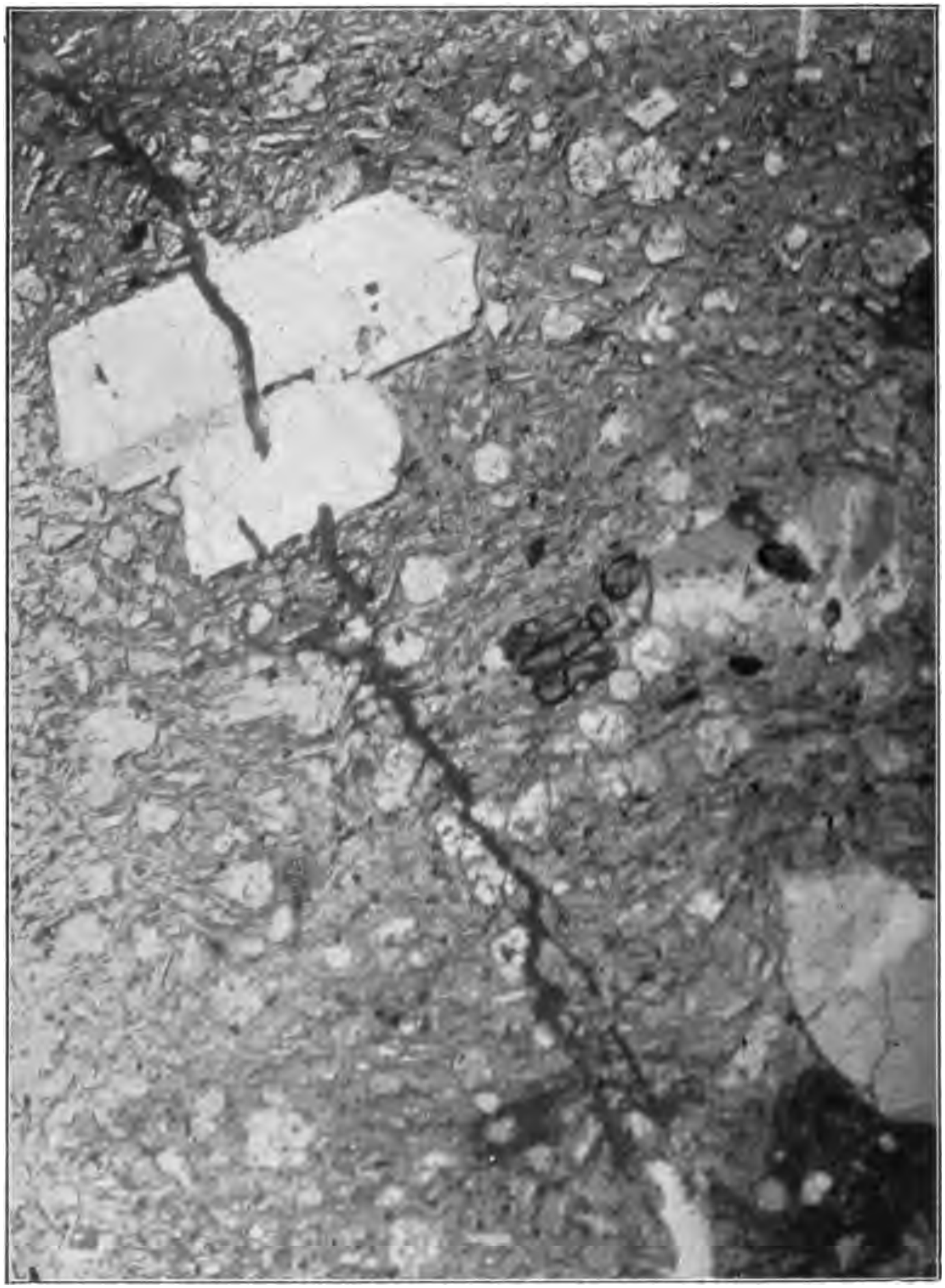
Altered Pyroxene Andesite containing microperthite, or **Soda Pyroxene Rhyolite.**

Locality.—The tip-head of the Waihi-Silverton Mine, Silverton Hills, Ohinemuri County.
Formation.—Kapanga group.
Remarks.—The black veins in the specimen are considered a sign favourable for the occurrence of gold in reefs that may chance to traverse this or the like rocks.

No. 278/452.

M.C.—Pitchstone breccia. Black glass in places free from phenocrysts, elsewhere loaded with glassy felspar.

U.M.—MATRIX ultra-microscopically granular somewhat brownish glass, with undulating or contorted stream-lines, indicated by elongated vesicles or streaks of more colourless glass. Crystallites are not very abundant, but short curved trichites, belonites, and stellate clusters of slender belonite-like rods may be observed. In places the glass passes into positive spherulitic growths. The crystals of the matrix are as follows:—



No. 278/452. ANDESIC PITCHSTONE.

[*To face p. 55, Vol. II.*

Plagioclase: Elongated rectangles, simple or twinned once or oftener; *r.i.*, above quartz; ext., parallel or undulose.

Quartz: Abundant bi-pyramids, giving sections that might be mistaken for tabular felspar crystals, sometimes corroded by magma, but almost invariably ophitic with felspar. This very remarkable feature seems to represent micro-pœcillitic structure.

Pyroxene: Small crystals and numerous grains of *magnetite*.

Phenocrysts.—*Plagioclase:* Well-formed glassy-clear crystals and clusters, with lamellar twinning; ext., 30°/30°, some 0°, but all with *r.i.* above balsam. Poor in inclusions.

Augite: A few small crystals and fragments of faint-brown augite, some beginning to pass into chlorite.

Hypersthene: Rarer even than augite.

Magnetite and *ilmenite:* A few crystals with which a *zircon* or two are associated.

Part of the slice is of a somewhat different character to the rest; it contains fewer crystals, and consists of more closely streaked glass. It includes xenoliths, one of hypersthene andesite.

The rock appears to be an **Andesitic Pitchstone.**

It would be interesting to know what percentage of silica it contains. The sp. gr. of the glass is about 2·46 to 2·48. This suggests andesite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, upper middle, which, in addition to showing the vein curiously displaced in the phenocryst which it traverses, is generally characteristic of the whole slice.

Locality.—Omahu Peak, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—A sample of this rock was sent with the first consignment of rocks to Professor Sollas. This, however, may not have been as characteristic of the formation as the present specimen. The first sample was No. 3838, and the descriptions may be compared.

No. 279/454.

M.C.—Violet-grey rock, porphyritic, with felspar and pyroxene.

U.M.—Matrix about half the rock; consists of almost colourless glass with abundant plagioclase laths in stream-lines; rarely pyroxene granules, and generally disseminated granules of magnetite.

Phenocrysts.—*Plagioclase:* Well-formed crystals, single or in groups; various twinning; ext., 20°/20°, 30°/30° (andesine–labradorite). Some highly zonal. Some very poor in inclusions. Some with scattered augite in the middle and submarginal or irregularly distributed. Threads of glass.

Augite: Fairly numerous crystals, faint-green, with traces of pleochroism; ext., up to 45°; twinned and intergrown.

Hypersthene quite as abundant as augite, if not more so, usually fresh, with well-marked pleochroism.

Magnetite: A few large grains.

Hyalopilitic Hypersthene Andesite.

Locality.—Western lower slope of Omahu Peak, Thames County.

Formation.—Beeson's Island group.

Remarks.—The specimen is from immediately east of the lower belt of rhyolite, at an elevation of 250 ft. above the sea. This and associated breccia rocks of an andesic character continue to about a height of 1,050 ft. on the north slopes of the mountain, but on the south slope the rhyolite descends to the level of the creek-bed and valley.

No. 280/456.

M.C.—Violet greyish-white banded rhyolite, with small elongated cavities.

U.M.—"Microfelsite," brownish-yellow in stream-lines, alternating with minute spherulitic and crystal-complex bands. The "microfelsite" is sometimes fibro-crystalline, the crystalline fibres being directed at right angles to the stream-lines in the marginal portions of a "microfelsite" band; more often it is isotropic, probably as a result of alteration; sometimes it consists of streaks of alternating crystalline and isotropic material; and frequently it is pervaded by an irregular network of dusty crystalline matter. Straight trichites, consisting of rows of granules like margarites, run through the "microfelsite" parallel with the stream-lines, except where a pronounced fibrous crystallization occurs in the marginal portion; the trichites are then directed in parallelism with the crystalline fibres.

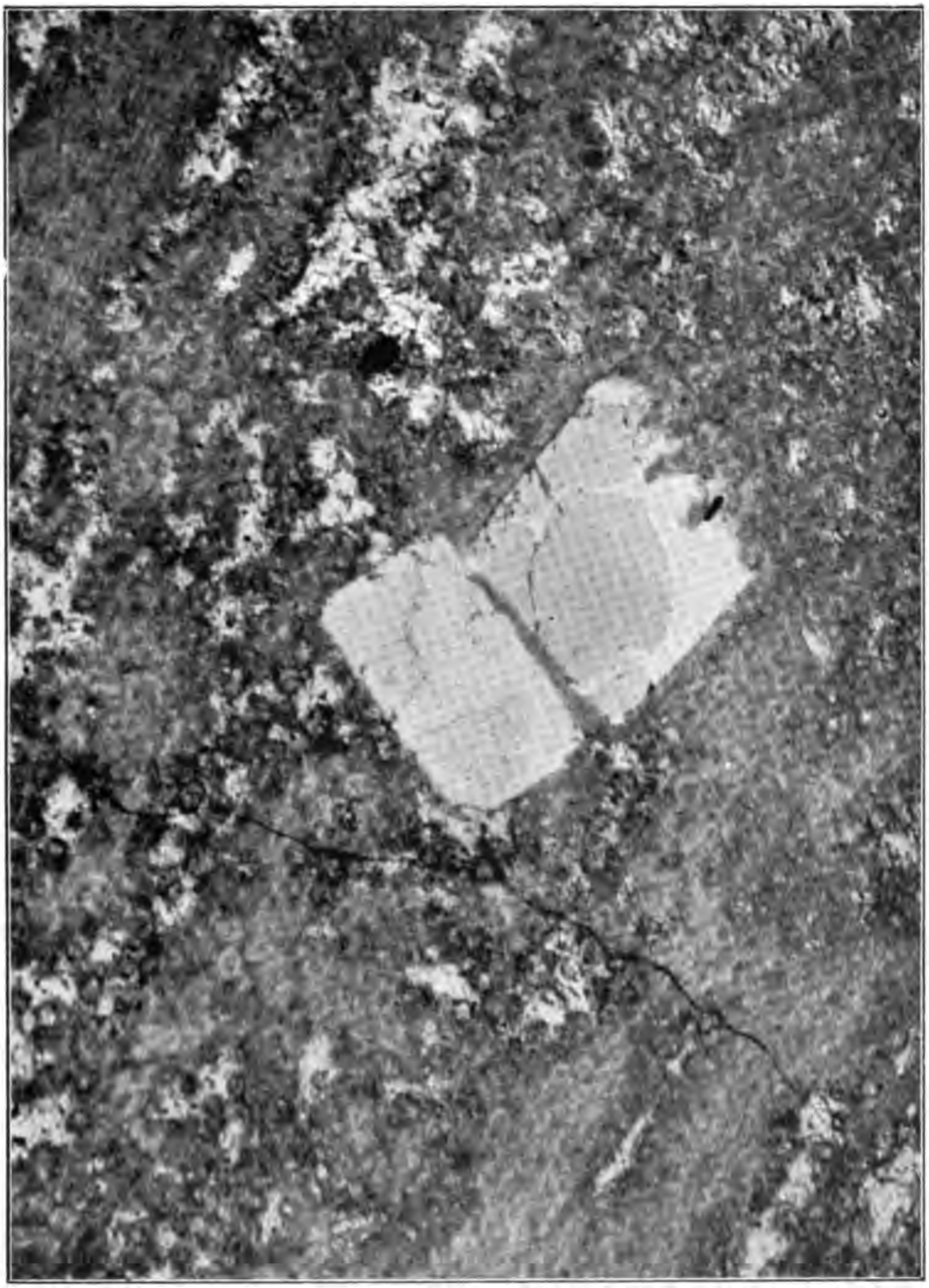
The alternating bands consist of very minute spherulites, frequently isotropic as a result of alteration, and of lanes and pools filled with definite crystals of felspar and tridymite.

PHENOCRYSTS.—*Plagioclase:* A few crystals and fragments, fresh; *r.i.*, above balsam; ext., low (oligoclase–andesine).

Pyroxene: A very few torn-out sections appear by their form to represent some species of pyroxene.

Iron-ores are rare, but there are a few pseudomorphs in leucoxene. There is no rhyolitic quartz.

Rhyolite, with plagioclase phenocrysts.



No. 280/456. RHYOLITE. [*To face p.* 56, *Vol. II.*

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 60 diameters; area photographed, middle part, which is fairly characteristic of the other parts of the slice.

Locality.—Saddle east side of Omahu Peak, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—On the saddle between the north and middle branches of Omahu Creek this rock is very soft and earthy in appearance, but on the adjacent range to the north-east and north the rhyolitic rock is much harder, and has the appearance of being bedded in thick masses.

No. 281/463.

M.C. — Purplish stony rhyolite, with diffuse spherulites and white felspar phenocrysts.

U.M.—Positive spherulitic material, " microfelsite," with abundant trichites in stream-lines having the same general direction throughout the rock. This material has the form of echinite or servicorn spherulites, and is fibro-crystalline, the fibres running across the stream-lines in the direction of the arms of the spherulites. The space between the arms of the spherulites is occupied also by positive spherulitic material, but in this the stream-lines, as indicated by the trichites, are contorted, and the material has the form of positive microspherulites, or may be confusedly crystalline.

The space between the echinite spherulites is occupied by positive microspherulites of larger size and more regular form (trichites are usually absent), and by lanes and pools of crystal complexes. When trichites are present they are sometimes arranged in circular spirals.

PHENOCRYSTS. — *Plagioclase :* A few crystals and fragments; *r.i.*, above balsam; ext., low (oligoclase–andesine).

Pyroxene : A few pseudomorphs in chlorite.

Quartz : A few rhyolitic grains.

Iron-ores not common, passing into leucoxene at the margin.

The history of this rock is clearly recorded in its structure. The phenocrysts were the first products of consolidation, as is shown by the manner in which the stream-lines pass round them. The trichites of the stream-lines were the next to solidify. The echinite spherulites followed, and were formed during a rapid consolidation, as is indicated by their fibro-crystalline character. A movement of the flow now set in again; the original stream-lines were generally broken up, and even between the arms of the echinite spherulites, where some protection was afforded, they were disturbed and contorted. This movement might conceivably be due to a final advance of the lava after a temporary pause, or to other causes which it is not necessary to discuss in this place.

Consolidation then recommenced, and gave rise to the small positive spherulites, leaving lanes and pools of still fluid material which crystallized out in ordinary crystal forms.

Evidently at the time the echinite spherulites consolidated the rock as a whole was still in a fluid condition. So much is shown by the subsequent contortion of the stream-lines between their arms.

Purplish Stony Spherulitic Rhyolite.

Locality.—Omahu Peak, northern higher slope, Thames County.
Formation.—Acid group of Pliocene age.
Remarks.—A sample of this rock was sent with and as part of the first consignment of specimens, but, as better-preserved specimens were afterwards collected, a second example, that above described, was forwarded for description. The first specimen forwarded is No. 3823.

No. 282/485.

M.C.—Light greenish-grey or greyish-white rock, with white felspar phenocrysts and chlorite pseudomorphs.

U.M.—MATRIX shows granular polarisation, due in large part to chlorite, abundant felspar laths in stream-lines, quartz grains, and leucoxene granules. Matrix about half the rock.

PHENOCRYSTS.—*Felspar:* Numerous crystals, very much altered, chiefly into mica; some felspar substance remains, and gives extinctions like orthoclase, parallel to 010, 001 edge, on 001 a few degrees, on 010 23° with 110, 010 edge; *r.i.* cannot be determined. The sections of the pseudomorphs are full of holes, from which carbonates might have been removed, but, if so, by general leaching of the rock, for this does not effervesce with acid.

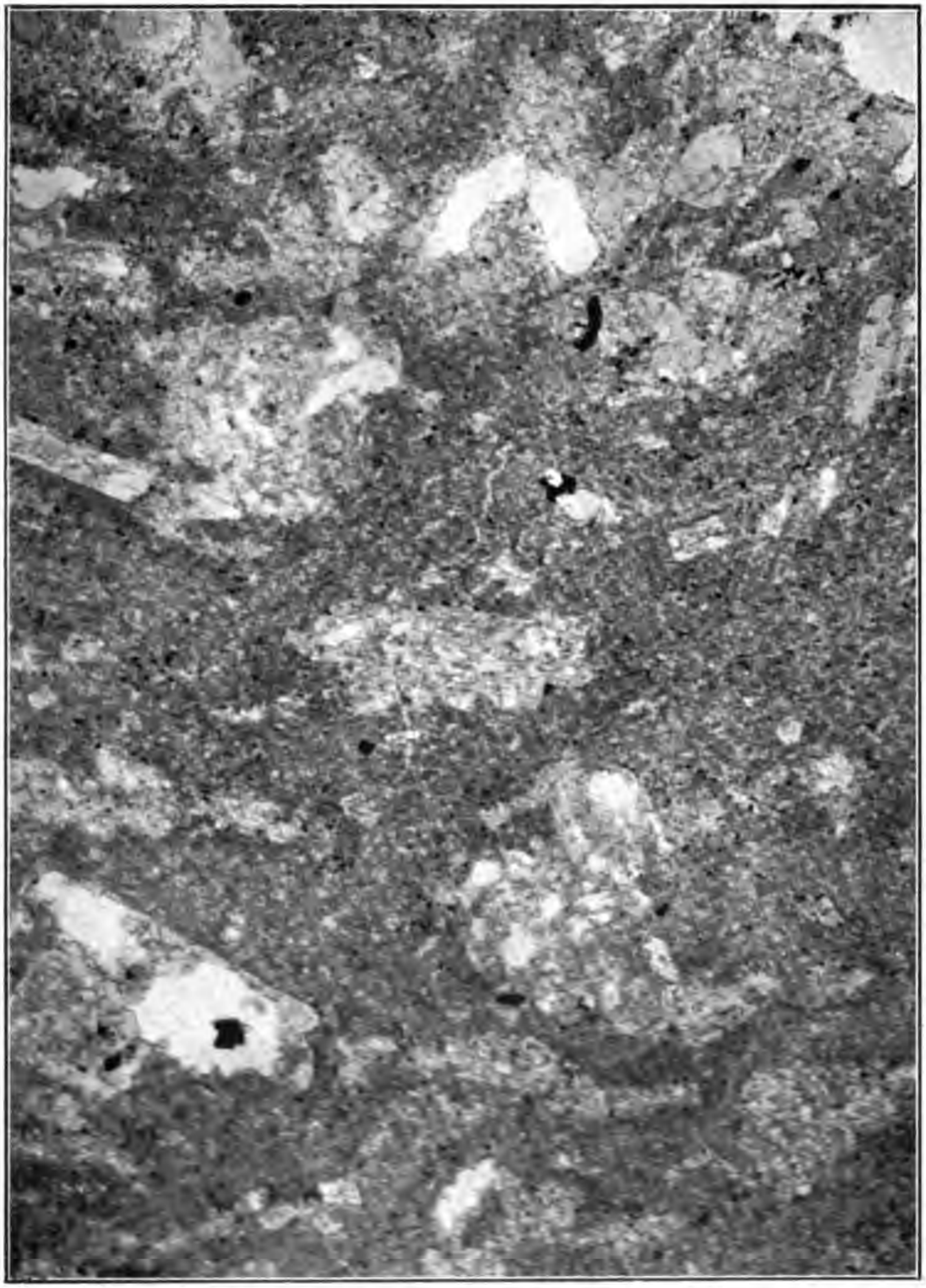
Pyroxene: Fairly numerous pseudomorphs in green chlorite (pennine).

Ilmenite represented by pseudomorphs in leucoxene.

Primary quartz grains absent, secondary quartz in association with chlorite.

Quartz felspar pyroxene flow rock, much altered; probably **Altered Pyroxene Rhyolite.**

Illustration.—Slice shows moderate contrasts.
Photographed by polarised light; magnification, 60 diameters; area photographed, lower right, which is characteristic of the whole slice.
Locality.—Imperial Mine, eastern slope of Karangahake Mountain, Ohinemuri County.
Formation.—Thames-Tokatea group.
Remarks.—The Imperial Mine is south of and contiguous to the area of the New Zealand Crown Mines, and the nature of the country is generally similar.



No. 282/485. ALTERED PYROXENE RHYOLITE.

[*To face p.* 58, *Vol. II.*

No. 283/494.

M.C.—Black basalt-like rock, with latent polygonal jointing.

U.M.—MATRIX: Brownish glass dusty with magnetite, crowded with plagioclase as felspar laths in stream-lines, and crystals of pyroxene.

PHENOCRYSTS.—*Plagioclase:* Numerous large crystals, groups, and fragments, broken in places; variously twinned; ext., 25°/25°; *r.i.,* above balsam; often highly zonal. Inclusions various. The most marked are fibre-like inclusions of glass, which almost entirely fill some of the crystals. These are sometimes traversed by coarser veins filled with serpentinous decomposition products. Pounded grains of augite occur as inclusions.

Augite: Chiefly in small crystals, occasionally in clusters, almost colourless; ext., 40°.

Hypersthene almost colourless, never fresh, partly or wholly converted into pseudomorphs of green serpentine "bastite." The hypersthene seems to be more abundant than augite.

Hornblende represented by resorption pseudomorphs.

Quartz by no means rare, in corroded grains, not surrounded by an aureole of green pyroxene.

Iron-ores (magnetite): Some large grains, *not* bordered by leucoxene; some zircons associated.

Apatite: Several large crystals, with black striation running parallel to long axis.

Serpentine occurs in radio-fibrous masses, as though filling irregular vesicles. With this, *tridymite* is associated in composite hexagonal twins.

This rock is not similar to No. 423, but is almost identical with Nos. 420 and 422. I had called it hypersthene dacite, but, though consistent with accepted classifications, this name does not seem very appropriate, and it will be better to use the term

Quartz Hypersthene Andesite, with hornblende.

Zirkel has the following remarks (Petrographie, Bk. ii., p. 812): "To the quartz pyroxene andesites those rocks (named enstatite dacite) appear to belong, which F. W. Hutton mentions from the Hauraki goldfields, in Auckland, New Zealand (quartz in comparatively rare but large grains with glass-inclusions)."

Locality.—Waihi Consols Mine, west of Martha Hill, Waihi, Ohinemuri County.
Formation.—Kapanga group.
Remarks.—This rock for close similarity or identity of its megascopic character may be compared with specimen No. 423 from the Waitekauri Valley. In some of the specimens from the Waihi Consols shaft serpentine is common as a product of decomposition of some other mineral. It seems that similarity in external appear-

ance is not to be relied on in a comparison of this rock with specimen No. 423, and that there is a far greater correspondence, almost an identity, between this and Nos. 420 and 422.

No. 284/497.

M.C.—Dark greenish-grey rock, with large white phenocrysts of felspar making up nearly half the rock.

U.M.—MATRIX: Finely granular polarising material, jagged quartz grains, leucoxene granules, chlorite after pyroxene, and pseudomorphs of felspar in flow-lines.

PHENOCRYSTS.—*Felspar* much torn out in grinding so that it cannot be determined; no doubt too much decomposed to cut.

Pyroxene abundantly represented by pseudomorphs, which retain in a perfect manner the outlines of the original crystals; many of the smaller crystals are markedly elongated and run in stream-lines. The replacing minerals are chlorite, carbonates, and quartz in minute jagged grains. The cleavage, transverse cracks, and outline are defined by opaque white material and pyrites granules. Apatite is present in the pseudomorphs. Minute crystals of pyrites are generally disseminated.

Altered Andesite.

Locality.—Grand Junction Mine, Waihi, Ohinemuri County.
Formation.—Kapanga group.
Remarks.—This is perhaps the most coarsely porphyritic rock occurring in the Waihi district. The bulk of the rocks from the Grand Junction shaft are breccias, and it can hardly be said whether this specimen was derived from a solid lava-stream or from a fragment forming part of a breccia.

No. 285/498.

M.C. — Greenish-black compact rock, with phenocrysts of felspar and ferro-magnesian minerals.

U.M.—MATRIX: Dusty irregular quartz grains, pseudomorphs of felspar laths, some few fresh; felspar rectangles, grains of carbonates, chlorite; may represent altered glass to some extent.

PHENOCRYSTS.—*Plagioclase* rather abundant, occurring as crystals, groups, and fragments; coarse irregular and fine regular twinning; ext., 13°/20°, 22°/26°, 30°/38° (andesine–labradorite). Inclusions various; may be a sub-marginal narrow zone now containing carbonates, or scattered crystals and grains of augite or green alteration products. In many cases the felspar is comparatively free from inclusions.

PYROXENES.—*Augite:* A few fresh crystals, beginning to pass into carbonates and chlorite.

Hypersthene: Abundant pseudomorphs in carbonates and green chlorite (pennine).

Quartz: One or two rounded grains.

Magnetite: A few large grains.

Hornblende represented by one or two resorption pseudomorphs.

Altered Quartz Andesite, with a little hornblende.

Locality.—First and main shaft of the Grand Junction Mine, Waihi, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—The bulk of the rocks from this mine are light-grey breccias of coarse or finer grain, and should the above description lead to the conclusion that the specimen is part of an undisturbed lava-floe the necessary correction is here made.

No. 286/499.

M.C.—Black compact rock, with phenocrysts of felspar and ferro-magnesian minerals.

U.M.—MATRIX: Brownish glass crowded with felspar laths in streamlines abundant, dispersed magnetite granules, and a few pseudomorphs in chlorite after pyroxene.

PHENOCRYSTS.—*Plagioclase:* Numerous crystals and clusters, zonal; various inclusions; fibrous glass network occupies almost the whole interior of some crystals; others almost inclusion free; some with zones rich in negative glass crystals; ext., 28°/39°, 30°/31° (labradorite).

Augite: Single crystals and clusters, including green pseudomorphs after hypersthene.

Hypersthene: Fairly abundant, as green serpentine pseudomorphs with undecomposed cores of hypersthene.

Hornblende: Several resorption pseudomorphs.

Quartz: A few large corroded grains.

Magnetite: A few grains.

Black Quartz Hypersthene Andesite, with hornblende.

Locality.—Waihi South Mine, Waihi, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This seems to correspond with a rock from the Waihi West Mine described by the late Professor Ulrich as a hypersthene augite andesite, an account of which is given in "Geology and Veins of the Hauraki Peninsula, Auckland," 1898, p. 27.

No. 287/504.

M.C.—Black compact rock, with small phenocrysts of felspar and pyroxene.

U.M.—Matrix minutely granular polarising material, felspar laths in flow-lines, irregular dusty quartz grains, pseudomorphs in chlorite, magnetite granules.

Phenocrysts.—*Plagioclase:* Numerous fresh crystals and clusters, occasional zoning; various inclusions, of which small crystals of pyroxene are the most interesting; ext., 27°/ 29°, 30°/ 33°, 32°/ 36° (labradorite).

Augite: Large crystals, faint-green colour; pleochroic, greenish / yellowish-green.

Hypersthene: Numerous large crystals, usual pleochroism, passing into green bastite.

Magnetite: Several large grains.

Black Hypersthene Andesite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper right, which is characteristic of the whole slice.

Locality.—Waihi Consols Mine, Waihi district, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—From the mine-shaft, 110 ft. from the surface.

No. 288/505.

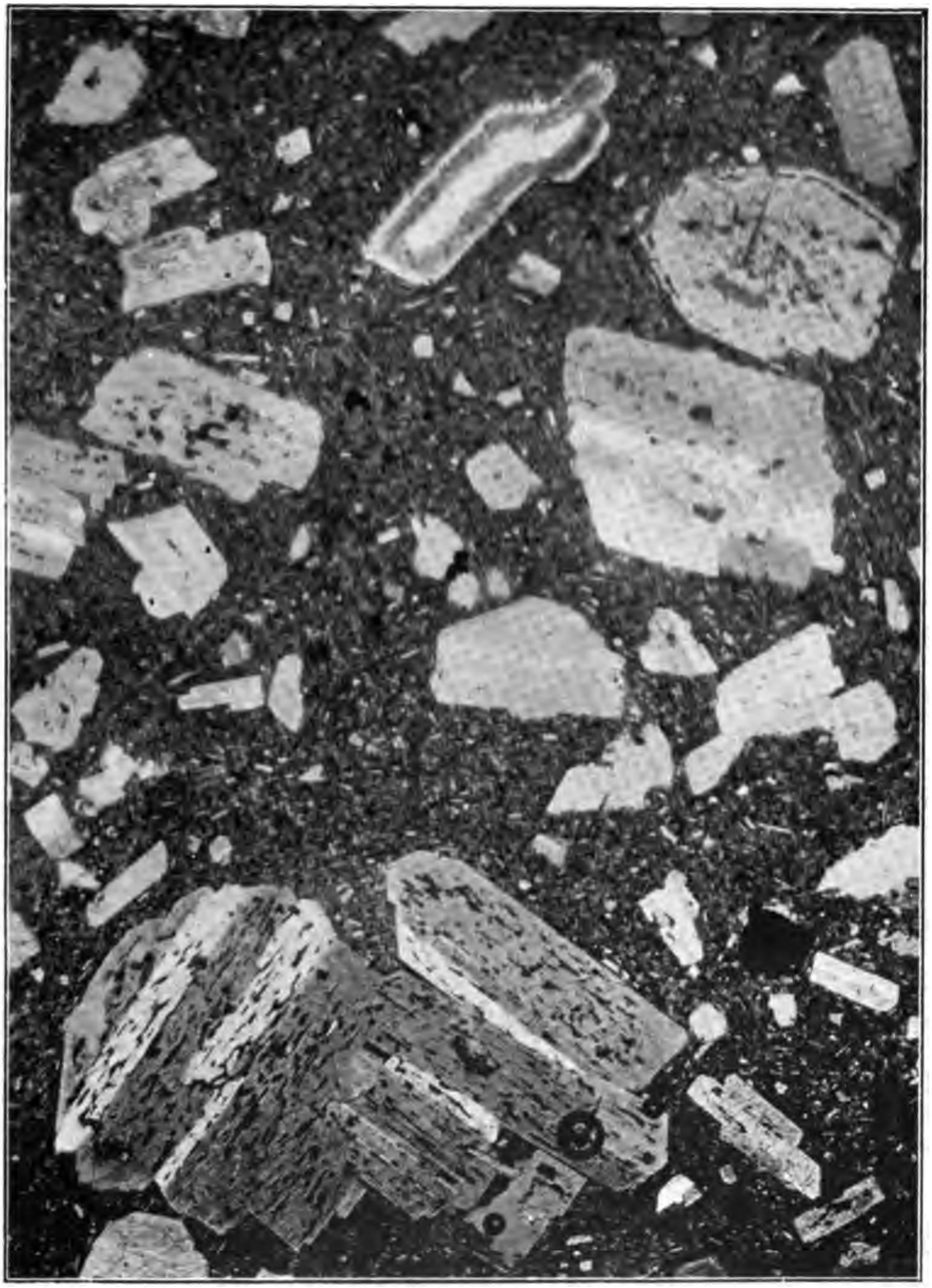
M.C. — Black compact rock, with phenocrysts of felspar and ferromagnesian minerals.

U.M. — Matrix: Felspar laths in stream-lines, crystals of augite and hypersthene, and magnetite granules in a brownish glass.

Phenocrysts. - *Plagioclase:* Large and numerous crystals and clusters and very irregular fragments. Inclusions various, some filled with fine fibrous network of glass, some with abundant negative crystals of glass, zonally arranged. Serpentinous decomposition products in some, others with included augite and magnetite. Twinning generally irregular; ext., 24°/ 26°, 28°/ 28° (andesine–labradorite).

Augite: Numerous but small almost colourless crystals, passing in some cases into serpentine.

Hypersthene: Abundant small crystals, but chiefly as cores to pseudomorphs in green bastite.



No. 287·504. BLACK HYPERSTHENE ANDESITE.

[*To face p. 62, Vol. II.*

Hornblende: Several large resorption pseudomorphs.

Magnetite: Some large grains.

Quartz: Several large corroded grains.

Black Quartz Hypersthene Andesite, with a good deal of hornblende.

Locality.—The Grand Junction Mine, Waihi, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This rock underlies the rhyolite of the plain west of Martha Hill and Waihi Township. It is not similar to the rocks under the Pliocene rhyolite of the Waihi Mine, and as yet it is more than doubtful if the Martha lode has been traced into these rocks.

No. 289/509.

M.C.—Greenish-grey, compact, lustreless rock, with ill-defined felspar phenocrysts and chloritic pseudomorphs.

U.M.—MATRIX granular polarising material, possibly kaolinised glass with dusty irregular quartz; no obvious felspar laths; dispersed granules of leucoxene, and occasional crystals of apatite.

PHENOCRYSTS.—*Felspar:* Numerous large crystals, more or less micacised, without development of carbonates; *r.i.*, below balsam; ext., 3° to 5° with 001, 010 edge on 010, 21° to 23° with 110, 010 edge, hence orthoclase. Carlsbad twins with symmetrical extinction of 21°.

Pyroxene represented by pseudomorphs retaining crystalline outlines (110, 100, 010), not very abundant, yet fairly numerous; composed of clear quartz mosaic, often with associated pyrites, or of chlorite, or quartz and chlorite.

Iron-ores represented by sphene and leucoxene. Corroded quartz grains are absent.

Apatite in striated prisms is common, especially in pseudomorphs after pyroxene.

Pyroxene Rhyolite.

Locality.—Waihi Union Mine, Waihi district.

Formation.—Kapanga group.

Remarks.—The specimen represents a class of country which is considered unfavourable to the presence of gold in quartz reefs that may intersect it.

No. 290/510.

M.C.—Light bluish-grey, lustreless, compact rock, with white felspar and chloritic pseudomorphs, here and there a small quartz grain.

U.M.—Matrix altered into white mica scales and carbonates. Felspar laths abundantly represented by pseudomorphs in stream-lines. Dispersed leucoxene granules and sporadic quartz grains present; pyroxene represented by chlorite.

Phenocrysts.—*Felspar:* Abundant small crystals; few large ones, and some of these fragmentary, much torn away in grinding, what remains highly micacised and full of carbonates.

Pyroxene: Well represented by numerous pseudomorphs in yellowish-green chlorite and carbonates.

Hornblende: A single resorption pseudomorph observed.

Quartz: Several grains corroded by matrix.

Iron-ores converted into leucoxene.

Pyrites generally small dispersed crystals; a few larger ones.

A Much-altered Quartz Felspar Pyroxene Flow Rock.

Locality.—Waihi West Claim, Waihi, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This rock lies on the west side of Martha Hill, and, as far as can be determined, on the west side of a line of fault separating the gold-workings on Martha Hill from mines on the flat to the westward, including the Waihi Consols and Waihi South Mines.

No. 291/512.

M.C.—White decomposed rhyolite, showing quartz grains.

U.M.—Matrix formed of quartz mosaics of irregular grains, and mica or kaolin, or both, in places alternating in streaks, which correspond with stream-lines.

Phenocrysts.—*Orthoclase:* Large crystals broken internally and partly replaced by matrix. Not numerous.

Quartz in fairly numerous large corroded grains.

Ferro-magnesian mineral represented by pseudomorphs in mica or kaolin, and brownish granular material.

Iron-ores converted into leucoxene.

Decomposed Rhyolite.

No. 292/517. COMMON OPAL. [*To face p. 65, Vol. II.*

Locality.—Madden's Folly Claim, on the north-east continuation of the Radical lode, Owharoa, Ohinemuri County.
Formation.—Kapanga group.
Remarks.—This rock is in the line of the continuation north-east of the rhyolites and older acid rocks developed at Owharoa, and was collected and sent as a rhyolite, but as in nowise connected with the younger rhyolites of Pliocene age that occur in the district to the east and south-east. This rock and the mine-workings whence it comes should dispel the idea of a slip or slide bringing rhyolite into the mine-workings of the Radical and other lodes at Owharoa.

No. 292/517.

M.C.—Common opal streaked brown in light and darker shades and greenish-grey.

U.M.—Small round or irregular areas of opal, leaving narrow interstices like a network filled with granular material, which under high magnification is seen to contain minute spherules and irregular granules of opal with colourless interstitial matter of a different *r.i.* Minute cracks traverse the interstitial material, giving it a still more granular appearance. The opal owes its streaky appearance to ferric hydrates, which stains it yellow, and which is more abundant in some bands than others. The slice is isotropic on the whole, but gives double-refraction effects in places, especially in narrow discontinuous bands, which cross the rock at right angles or transversely to the general streakiness. In places where ferric hydrate is more than usually abundant a distorted cross appears between *x.n.*

On heating in a closed tube water with an alkaline reaction is given off. Before the blowpipe infusible even in thin splinters. In sp. gr. column of methyline iodide and carbon tetrachloride it floats at the same level as common opal from Brazil.

Common Opal.

Illustration.—Slice shows good contrasts.
Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which is characteristic of the whole slice.
Locality.—Boardinghouse Creek, Waikino, Ohinemuri County.
Formation.—Kapanga group.
Remarks.—This rock in and about Waikino is common in the gravels of the Ohinemuri River, especially in the high-level terraces, due to the former action of the stream.

The specimen forwarded was obtained at the waterfall in the creek above named, but the rock could not be found *in situ*. On showing a sample of the rock to Mr. Corbett, of Hikutaia, he stated that about 2 chains above the waterfall and on the left side of the east branch of the creek a vein of this material was driven on some 30 ft., under the belief that it was a variety of quartz which might carry gold. Floods subsequently swept away the material excavated, and the few larger blocks at the foot of the waterfall are now the only pieces not carried into the Ohinemuri.

No. 293/518.

M.C.—Greyish somewhat lustrous rhyolite, with small elongated vesicles.

U.M.—The slice is seen to be chiefly composed of contorted flow-shreds, of the form supposed to be characteristic of tuff, the interstices filled with darker more granular glass. The tuff-like bodies contain globulites (? of opal), and spirally curved thread-like crystallites, which would be called trichites were they not transparent. The most remarkable feature they present lies in their crystalline character; this is not universal; some are still isotropic, but many are bright between *x.n.* The extinction is patchy or undulating, or in some cases distinctly that of fibrous crystalline material, and the fibres are sometimes more or less radiate, frequently transverse to the length of the shred. There can be no manner of doubt about the originally glassy character of these threads; their crystalline character at present is obvious, and thus we seem to have definite evidence for secondary devitrification. The only escape from this inference lies in the possibility that the contorted threads were not wholly solid, but simply viscous after they acquired their form.

PHENOCRYSTS.—*Plagioclase:* A few crystals, clusters, and fragments, some zonal, twinned; ext., 11°/0° (oligoclase–andesine); *r.i.*, above balsam, even when extinction parallel.

Magnetite and *zircons* sparingly present.

Some patches of positive spherulitic growth occur here and there in the matrix.

Xenoliths of the groundmass of a rhyolite included.

Rhyolite, with plagioclase, showing contorted flow-lines.

Illustration.—Slice shows but moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper middle, which is characteristic of the whole of the slice.

Locality.—Waterfall, Boardinghouse Creek, Waikino, Ohinemuri County.

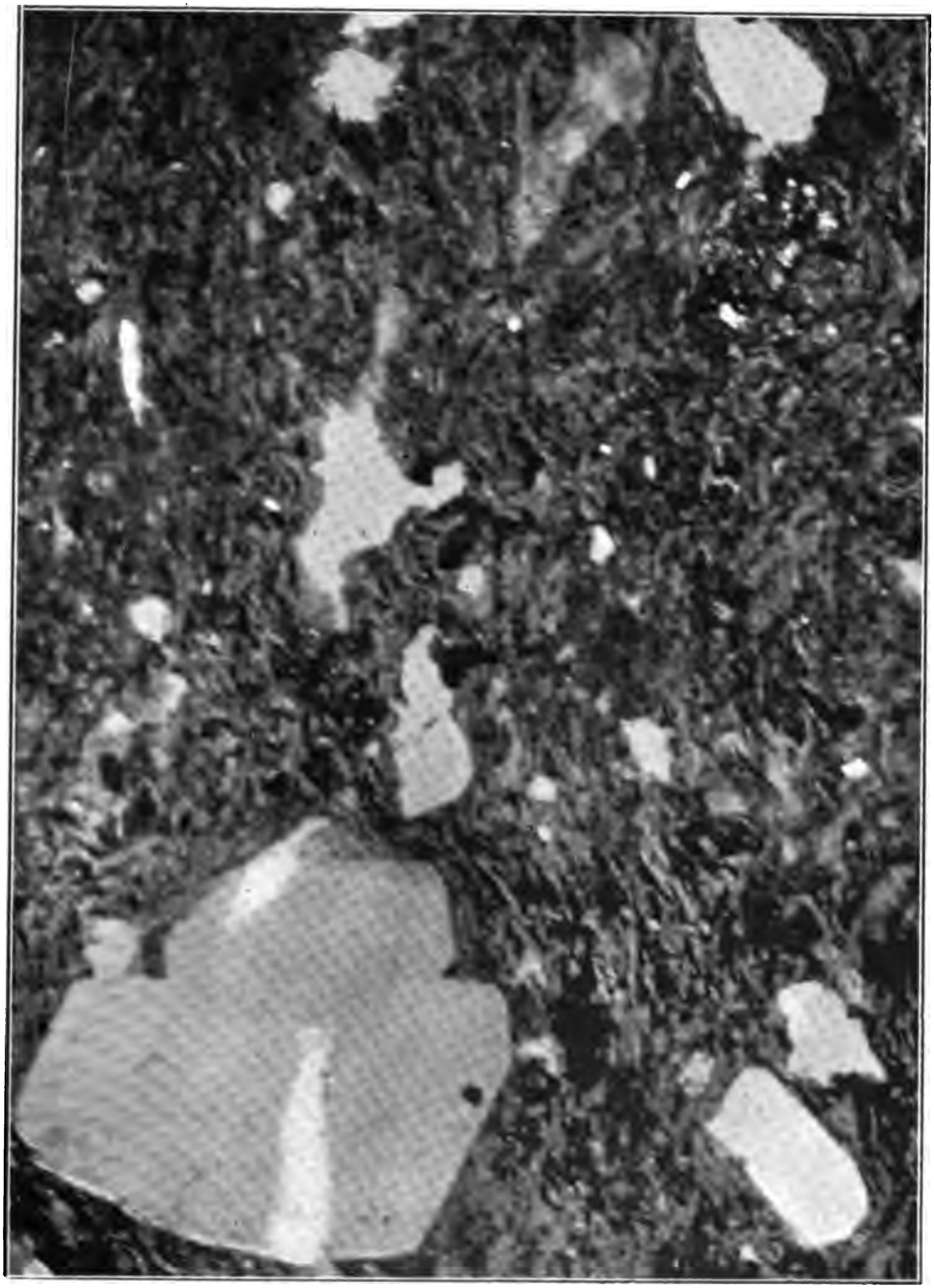
Formation.—Acid group of Pliocene age.

Remarks.—This rock is doubtfully referred to the base of the acid group of Pliocene age. It rests on a more porphyritic rock, which, more resembling an andesite, is seen in the banks of the Ohinemuri at the bridge between Waikino and the Victoria battery. About 3 chains distant is the band of "common opal" which was mined some distance, but this latter standing nearly vertical must belong to the acid rocks of the Kapanga group as developed at Owharoa.

No. 294/521.

M.C.—Similar to the preceding specimen (No. 293/518).

U.M.—The character of this rock is that of the preceding, with differences of unimportant detail only.



***No.* 293/518.** RHYOLITE.

[To face p. 66, Vol. II.

The groundmass is more homogeneous, consisting almost entirely of contorted threads, which are defined from one another by a thin granular layer, only one granule thick. The same globulites and spiral or undulating thread-like crystallites are present. The latter are the most prevalent. They are commoner near the margin of the contorted tuff-like bodies than in their centre. In unusually broad examples of these bodies the central part may be devoid of them.

PHENOCRYSTS.—*Plagioclase:* Fresh and glassy-clear; inclusions usually absent. Some apatite may be present, and sometimes large negative crystals or irregular cavities filled with glass. The plagioclase is frequently fragmentary and corroded by the matrix; zonal; twinned after various laws, including the albitic; ext., 27°/ 28° (andesine–labradorite).

Hypersthene: Fragments; one small long prism with frayed ends contains numerous negative crystals of glass running parallel with the long axis.

Augite: A few crystals. Both probably derived.

Magnetite and associated *zircons* sparingly present.

Xenoliths: Numerous small xenoliths, including different varieties of andesite, one characterized by a base of violet glass.

Rhyolite, with plagioclase, showing contorted stream-lines.

Locality.—No. 2 level, Martha lode, Waihi Mine, Waihi, Ohinemuri County.

Formation.—Acid group of Pliocene age.

Remarks.—This rock was taken 180 ft. from the surface, and is possibly, except in colour, not different to the light-grey rhyolite that appears at the surface. Park states that on the south-east slopes of Martha Hill, in the Waihi Mine, there are two thick bands of fine- and close-grained rhyolite, separated from each other by a spongy pumiceous rock that forms the upper surface of the lower deposit.

No. 295/527.

M.C.—Light greenish-grey rock, with obvious quartz and pyrites.

U.M.—MATRIX granular, polarising, much altered, crowded with felspar laths in stream-lines, which are obvious with ordinary light, but scarcely visible between *x.n.*, most of them not at all. Irregular quartz grains; some chlorite and scattered leucoxene granules.

PHENOCRYSTS.—*Orthoclase:* Numerous large crystals, beginning to pass into muscovite. Some fimbriate at the margin, showing continued growth after extrusion. Pyrites crystals included in some.

Hornblende represented by numerous resorption pseudomorphs.

Pyroxene represented by pseudomorphs in chlorite, small, and not very numerous.

Quartz : A few corroded grains and bi-pyramids.

Ilmenite : A few plates in leucoxene.

Pyrites : Numerous scattered crystals.

Hornblende Pyroxene Rhyolite.

Locality.—No. 3 level, Waihi Mine, Waihi, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—From near No. 2 shaft. The rocks contiguous to the lodes in the Waihi Mine are usually much decomposed.

That this is a rhyolite is a most important determination, seeing that here we have the richest gold-mine in the whole of the Cape Colville Peninsula, and one that promises to continue as rich as at present for many years yet to come.

No. 296/534.

M.C.—A dark spherulitic rock, with hornblende.

U.M.—MATRIX almost a mosaic of positive spherulites; interstices when they occur occupied by clear colourless material, apparently quartz, containing granules of red iron-oxide. Spherulites very regular, radio-fibrous structure, interrupted usually by one concentric zone, possibly indicating an interruption in growth; between *x.n.* give more sectors than correspond to a rectangular cross. The phenocrysts frequently serve as a nucleus to the spherulites.

PHENOCRYSTS.—*Plagioclase :* Large much-broken crystals and clusters, often highly zonal, various twinning; *r.i.*, above balsam; ext., 12°/ 14°, 11°/ 13° (oligoclase–andesine). Inclusions various; zonal inclusions of glass in large negative crystals or a crowd of small vapour-like cavities; pyroxene also included.

Hornblende : Somewhat common, crystals (elongated prisms) entire or more usually broken, with or without a reaction border; ext., 19°. Pleochroic, straw-yellow / deep olive-green.

Pyroxene probably represented by a few serpentinous pseudomorphs.

Quartz in numerous much-corroded grains.

Magnetite and *zircons* associated.

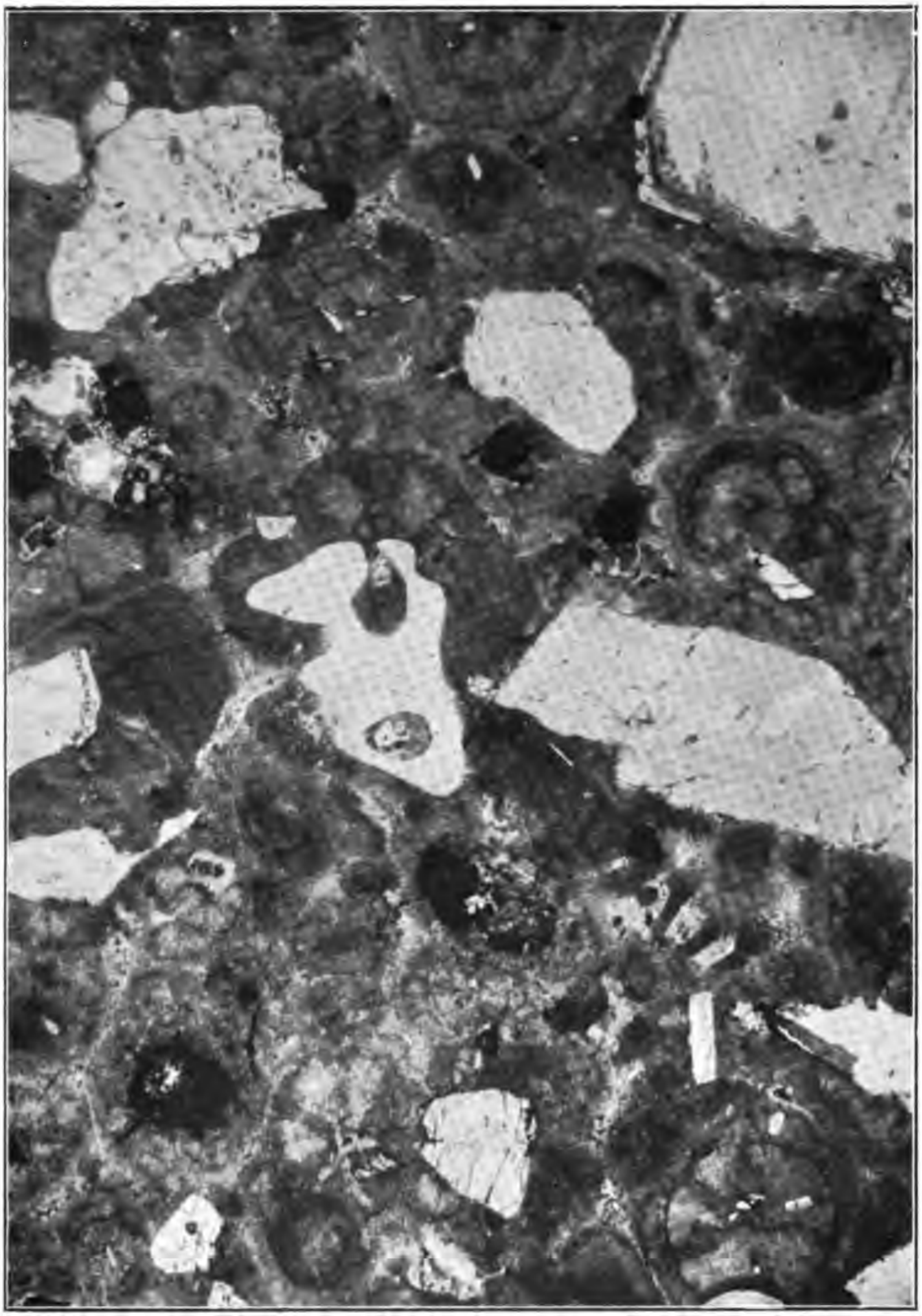
Apatite rather common, especially as an inclusion in hornblende and in serpentinous pseudomorphs.

If our nomenclature is to be determined by the phenocrysts this should be a

Spherulitic Hornblende Dacite,

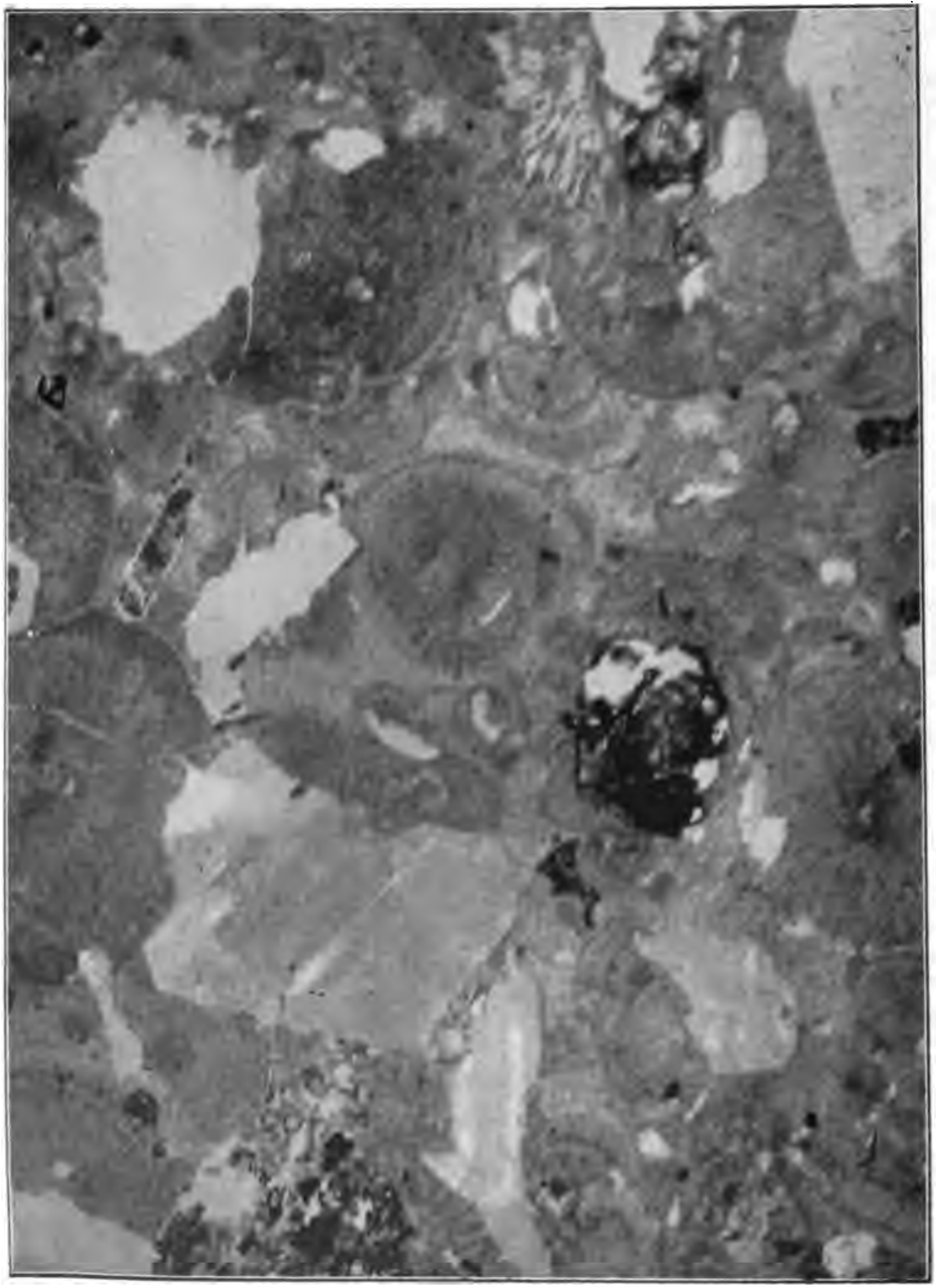
reminding us of the spherulitic dacites of north-west America.

Illustration.—Slice shows good contrasts.



No. 296/534. **SPHERULITIC HORNBLENDE DACITE.**

[*To face p. 68, Vol. II.*



No. 297/541. SPHERULITIC HORNBLENDE PYROXENE DACITE.

[To face p. 69, Vol. II.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which is, considering the nature of the specimen, fairly characteristic.

Locality.—Door Tunnel, Owharoa, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This rock is from the same place as that numbered 553, and the two may therefore be regarded as duplicates of each other. The spherulitic rocks of Owharoa have remained unrecognised from the early days of the goldfield till the present time. The light-grey rock of the Radical Mine was regarded simply as "miners' sandstone," and the darker rocks of the Door Tunnel were overlooked or regarded as a hard bar in the light-grey and softer country.

No. 297/541.

M.C. — Greenish-grey rock, minutely spherulitic, with obvious quartz, felspar, and altered ferro-magnesian crystals.

U.M.—MATRIX consists chiefly of positive spherulites like those of the preceding rock, but not so crowded, more various in size, more colourless and transparent. The interstitial matter is coarser spherulitic material, or glass containing crystals of [?].

PHENOCRYSTS. — *Plagioclase:* Numerous crystals and complexes, often rounded or broken; *r.i.*, above balsam; ext., low (oligoclase–andesine).

Hornblende: A few resorption pseudomorphs.

Pyroxene represented by pseudomorphs in green and colourless serpentine and quartz, not abundant, but seem to be commoner than hornblende; some suggest hypersthene.

Biotite: One or two crystals straw-yellow / black.

Quartz: Numerous corroded grains, some with large zonal inclusions of positive spherulitic fibres.

Magnetite, zircons, and *apatite* sparingly present.

Spherulitic Hornblende Pyroxene Dacite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper left, which fairly represents the whole of the slice.

Locality.—Door Tunnel, Owharoa, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—These rhyolites of Owharoa belonging to the Kapanga group are so unlike any of those of the Pliocene period in the same neighbourhood that it is surprising that they could be confused one with the other.

No. 298/547.

M.C.—Greyish-white lustreless rhyolite, porous, with phenocrysts of quartz and felspar.

U.M.—MATRIX consists of positive spherulites, some well formed, some diffuse; interstices either empty or filled with prisms of quartz forming more or less of a mosaic.

PHENOCRYSTS.—*Orthoclase:* Numerous large crystals and complexes highly cavernous, sometimes showing microperthite structure; probably contains a good deal of soda.

Hornblende: One or two resorption pseudomorphs.

Quartz: Fairly numerous large corroded grains.

Magnetite and *ilmenite* passing into leucoxene.

Some disseminated pyrites and ferric hydrate.

Spherulitic Rhyolite, with orthoclase and microperthite.

Illustration.—Slice shows but moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower left, which is characteristic of the rest of the slice.

Locality.—Ohinemuri Syndicate's shaft at Owharoa, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—This though a light-grey rock does not present any of the characters of the rocks in this neighbourhood usually recognised as rhyolite. At sight the rock passes very well for the ordinary decomposed andesite or sandstone of the miner, and it is only when more particularly examined that its true character may be detected.

No. 299/549.

M.C.—Light-grey or greyish-white lustreless spherulitic rhyolite.

U.M.—MATRIX resembles that of No. 298/547.

PHENOCRYSTS.—*Felspar:* None present in the slices; may be torn out; may be represented by pseudomorphs in quartz mosaic and pyrites.

Hornblende represented by resorption pseudomorphs filled with quartz mosaic.

Quartz: Numerous highly corroded grains.

Leucoxene disseminated in granules; a good deal of pyrites, especially in the pseudomorphs; it forms the greater part of one hornblende resorption pseudomorph.

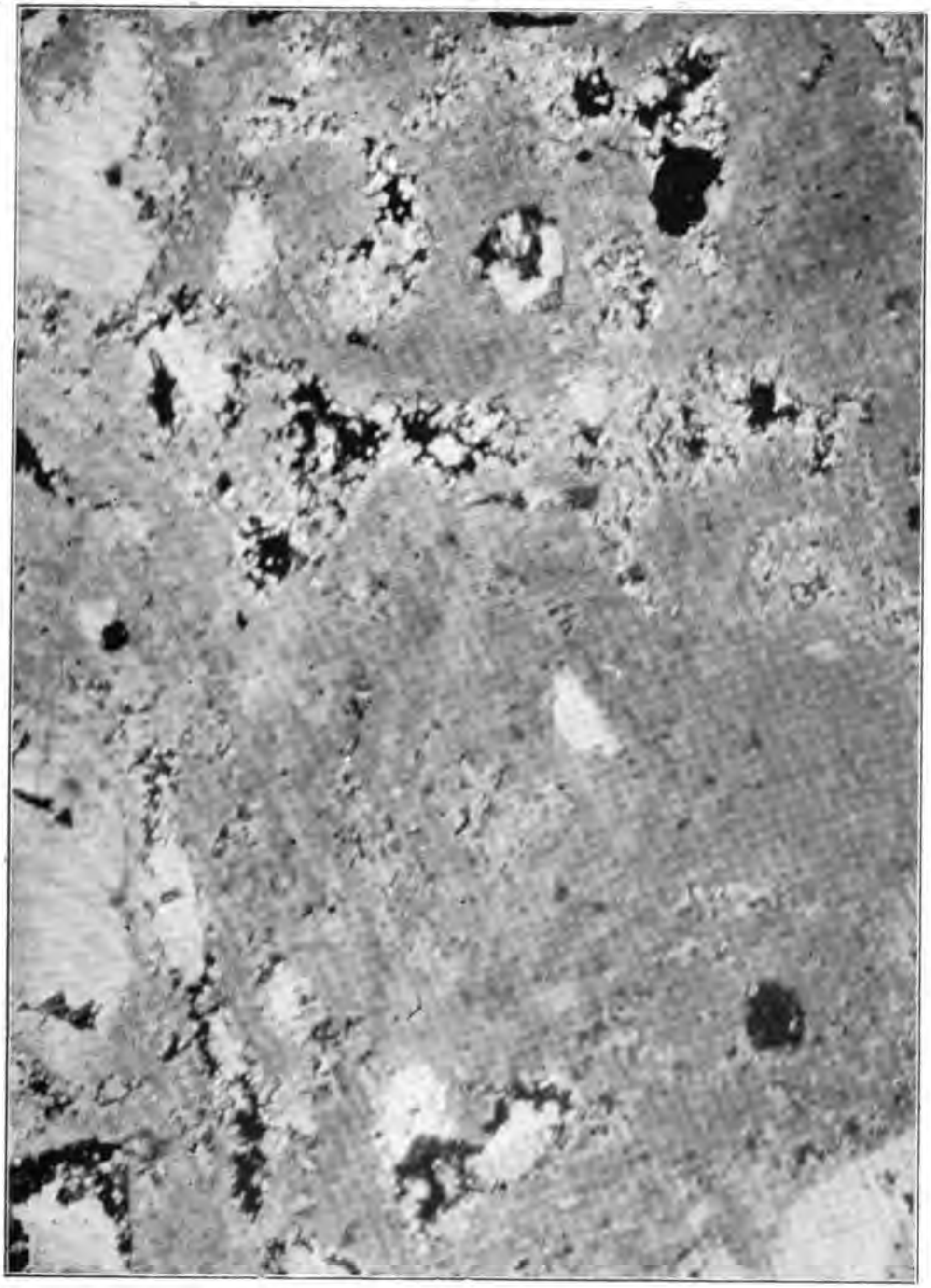
Spherulitic Rhyolite, much altered by siliceous waters.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper left, which is fairly representative of the rest of the slice.

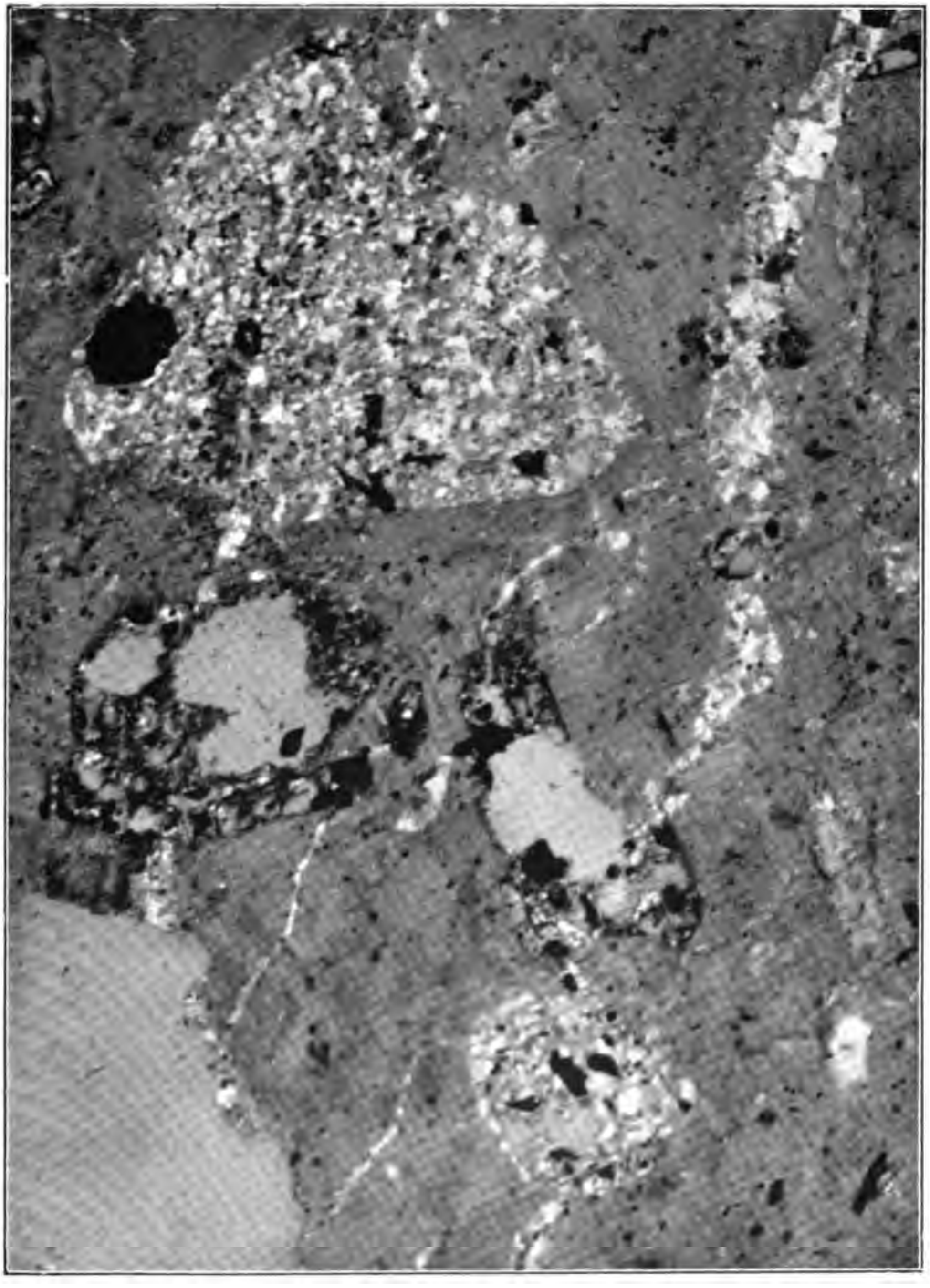
Locality.—Ohinemuri Syndicate's shaft at Owharoa, Ohinemuri County.

Formation.—Kapanga group.



No. 298/547. SPHERULITIC RHYOLITE. [*To face p.* 70, *Vol. II.*

i.



No. 299/549. SPHERULITIC RHYOLITE. [*To face p. 70, Vol. II.*

ii.

Remarks.—This rock is from the level 210 ft. from the surface and about 60 ft. from the shaft north-west towards the old workings of the Radical Mine. The position of this rock is of importance, as it has been reported and the opinion copied that the rhyolites at Owharoa occur as a slide filling an old gully; but these rocks, Nos. 547 and 549, are from nearly 200 ft. below the bed of the Ohinemuri River, the deepest natural excavation in the district since the outpouring of the Pliocene rhyolites.

No. 300/553.

M.C.—Dark-grey spherulitic rock, with phenocrysts of felspar, quartz, and hornblende.

U.M.—MATRIX similar to that of No. 296/534, differing only in trivial details; the spherulites seem to be scarcely so fresh, and there is less red iron-oxide in the interstices.

PHENOCRYSTS also similar.

Spherulitic Hornblende Dacite.

Locality.—Door Tunnel, Owharoa, Ohinemuri County.
Formation.—Kapanga group.
Remarks.—The same as for specimen No. 534.

No. 301/556.

M.C.—Dark-grey spherulitic rock, with crystals of hornblende and felspar and quartz grains.

U.M.—MATRIX: Brown perlitic glass, partly fresh, partly altered into hydrated crystalline material. The fresh glass is ultra-microscopically granular, and contains belonites, forked felspar microliths, and magnetite grains. Spherulites, positive in character, of about the same size as the "pearls" of the glass, and resembling those of the preceding rock, are numerous.

PHENOCRYSTS.—*Plagioclase:* Numerous fragments, often highly irregular in form; *r.i.*, above balsam; ext., 7°/ 9°, 20°/ 21° (andesine). Some of the crystals brecciated *in situ*, the fragments partly separated and the interstices between them filled with glass.

Hornblende: Fairly numerous crystals like those in the preceding rock, as well as resorption pseudomorphs.

Pyroxene represented by pseudomorphs retaining characteristic outlines of pyroxene; there are several of these.

Magnetite: A few large grains.

Quartz: A few rounded grains and splinters.

Glassy and Spherulitic Hornblende Pyroxene Dacite.

Locality.—Door Tunnel, Owharoa, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—There is some resemblance between this specimen and the flinty opaline rocks of the lower tunnel on the Ruapehu Claim, south-west from Owharoa.

No. 302/582.

M.C.—White or greyish-white rock, with phenocrysts of felspar and quartz, hornblende pseudomorphs, and spherulites.

U.M.—MATRIX almost wholly spherulitic; spherulites like those in the preceding dacites, invaded by quartz, which traverses the slice in a thin vein, forms mosaics within some of the spherulites, sporadic grains in the felspar, and fills minute cracks through the spherulites and about their margin. Leucoxene in scattered granules.

PHENOCRYSTS. — *Microperthite,* or *Soda Orthoclase:* Numerous corroded crystals, cavernous, partly muscovitised and invaded by quartz.

Pyroxene represented by one or two pseudomorphs in quartz mosaic.

Quartz : Fairly numerous corroded grains and bi-pyramids.

Iron-ores passing into leucoxene, and some large zircons.

Pyrites : Some disseminated pyrites, particularly in quartz vein.

Spherulitic Rhyolite, with microperthite.

Illustration.—Slice shows fair contrast of the different parts.

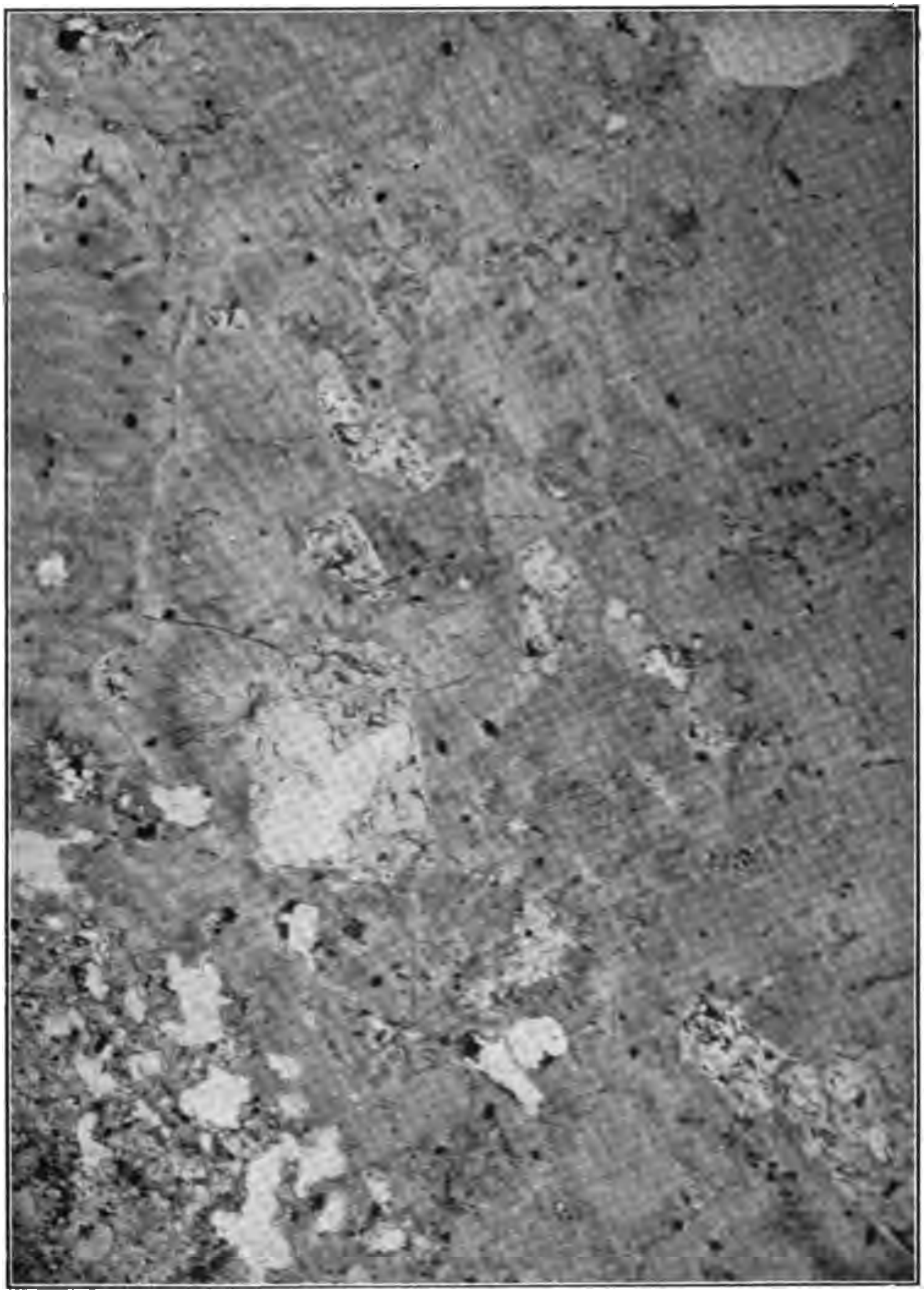
Photographed by polarised light; magnification, 33 diameters; area photographed, upper middle part, which is characteristic of the rest of the slice.

Locality.—Old workings on the left bank of the Ohinemuri River, opposite Owharoa, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—Reference has already been made to the nature of the rock in which gold-mining is being carried on at Owharoa. Of the several specimens described from this locality, some are designated rhyolite, others spherulitic dacite, and the spherulitic character is common to both. In the particular case of the specimen under description, megascopically the rock *in situ* is almost wholly composed of spherulites, and is apparently superior in position to the less spherulitic rhyolites in which the Ohinemuri Syndicate's mine-workings are being carried on, and the old workings of the Radical Mine, which again are highly spherulitic, the lowest rocks of the series at the pool in the Ohinemuri River being again without spherulites. These and the same rocks on the Ruapehu Claim within the Waitawheta watershed, at Waikino, and in the Waitekauri Valley constitute a division of the Kapanga group, that may be studied in connection with the pyroxene rhyolites of the Waihi Mine and the Silverton Hills of the Waihi district on the one hand, and the spherulitic rhyolites of the north-west spur of Karangahake Mountain on the other hand.

A study of the relations of the older acid rocks in the three localities (Owharoa, Waihi, and Karangahake) is of importance, and deserves more attention than has yet been devoted to the subject.



No. 302/582. **SPHERULITIC RHYOLITE.**

[*To face p. 72, Vol. II.*

No. 303/608.

M.C.—White porous decomposed rhyolite.

U.M.—MATRIX: A fine-grained mixture of an isotropic decomposition product which stains with fuchsine, and minute feebly double-refracting crystals. Remains of microliths in stream-lines may be detected. In places the matrix becomes coarser-grained, forming streaks and pools of crystal complexes like those almost always met with in these rhyolites as resulting in the last phase of consolidation. The complete decomposition of one of the constituents of these complexes in this case affords an excellent opportunity of studying the surviving one. The fact that it has resisted decomposing action to which all the rest of the rock has yielded is significant; its low double refraction, its negative optic sign (taken in relation to the long axis of the crystal), and its parallel extinction, are all characters consistent with tridymite. On dissolving a slice from the glass slide, removing all balsam, and mounting in bitter-almond oil (*r.i.*, 1·486) the supposed tridymite became almost invisible by ordinary light, and examined by Becker's method proved to have *r.i.* 1·486. It is therefore tridymite, and the suggestion arises whether the minute crystals which contribute to the mass of the matrix may not be identified with the same material. The tridymite in the coarser-grained regions has not the commonly occurring imbricated structure so often given as characteristic in text-books, and spoken of by Rosenbusch as being met with almost without exception.

PHENOCRYSTS. — These are fairly numerous, as may be seen from examination of the hand-specimen, but they have disappeared from the section in the process of grinding, only fragments of a few remaining; these have undergone the same kind of complete alteration as has affected the matrix.

Minute cavities occur in the rock, and the coarser-grained magma occurs around them.

Decomposed Rhyolite.

Locality.—Saddle between Omahu Peak and the main range to the eastward, Omahu district, Thames County.

Formation.—Acid group of Pliocene age.

Remarks. — This appears to be a decomposed condition of the rock represented by specimen No. 456. The section is continuous and clear between the localities of the two specimens, and in this as followed westward the rock gradually gets softer and more earthy in appearance till the saddle is reached. It was thought at the time of collection that the specimen might possibly represent the Tairua tuffs of Park's report on the "Geology and Veins of the Hauraki Goldfields." The rock, however, is pronounced rhyolite, and does not belong to the Thames-Tokatea group or the older auriferous andesites of the Thames district.

No. 304/612.

M.C.—Greyish-white rock, with included fragments of various other rocks and scattered crystals.

U.M.—MATRIX : Brownish, finely granular, isotropic; full of tuff-like splinters and irregular fragments of vesicular glass, pumice, splinters of felspar, and quartz.

Included fragments of larger size as follows : Positive spherulitic rhyolite; negative microspherulitic rhyolite with flow-lines; pumice, altered, abundant; andesite with pyroxene pseudomorphs. Plagioclase glassy-clear; *r.i.*, above balsam (oligoclase–andesine); often zonal, and rich in glass-inclusions, a fragment recalling by the character of its quartz the andesitic pitchstone, No. 278/452. Quartz grains not numerous. Some felspar crystals are partly coated with colourless transparent vesicular glass, precisely as in the case of ejected crystals found amidst the dust of a modern volcanic explosion. In some cases this glass shows positive spherulitic structure.

There are no signs of flow, nor of stratification.

Consolidated Volcanic Ash.

Locality.—Middle branch of Omahu Creek where it crosses the road to Whangamata, Omahu district, Thames County.

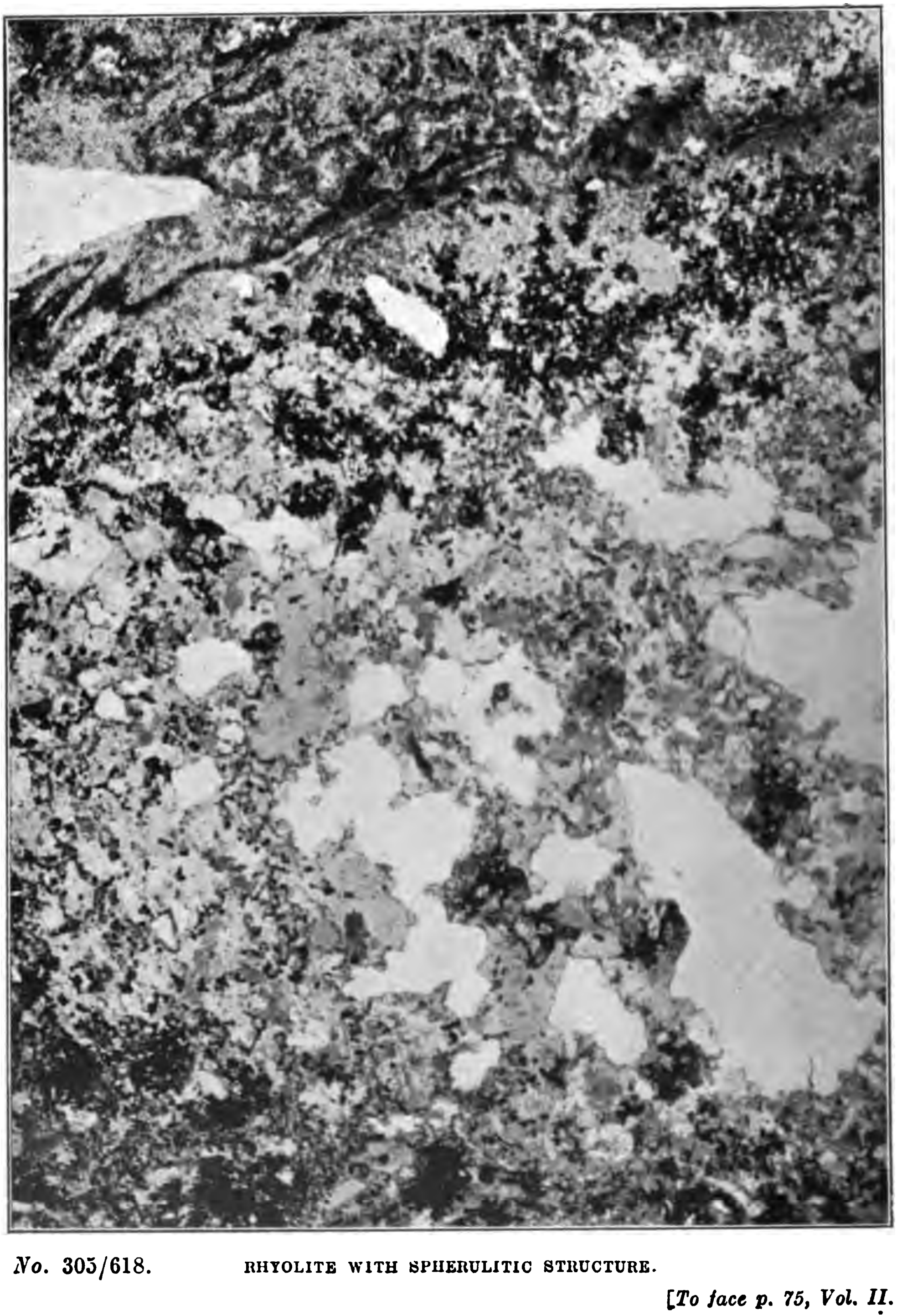
Formation.—Acid group of Pliocene age.

Remarks.—The specimen represents the lower part and more compacted condition of the pumiceous agglomerate, the less consolidated form of which is abundant higher on the range to the east. This rock is auriferous in the Klondike Claim on the spur south of the creek.

No. 305/618.

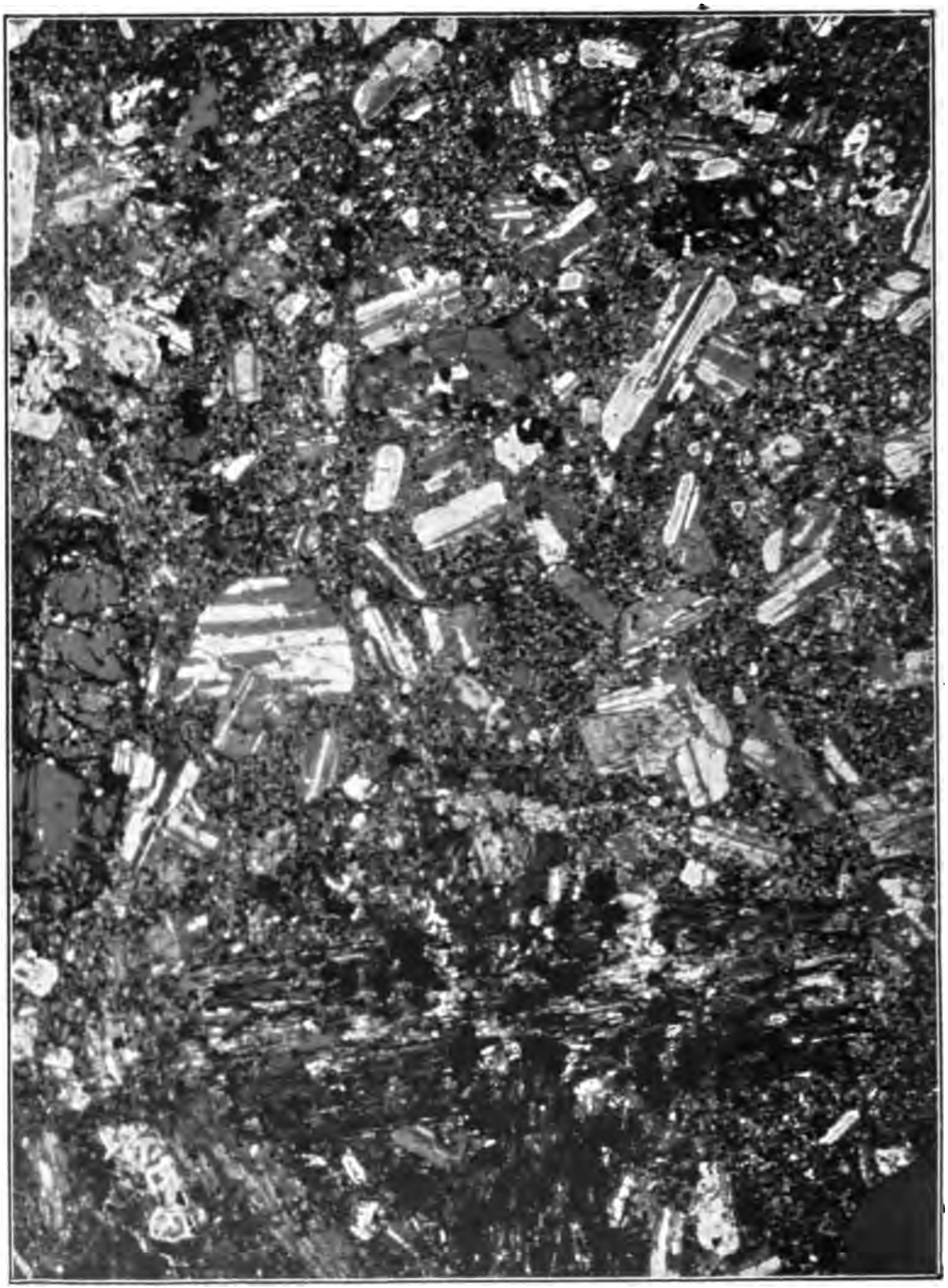
M.C.—Flow rock, streaked with brownish and bluish-grey bands, spherulitic, and lithophysal, with small phenocrysts of felspar.

U.M.—MATRIX so-called "microfelsite," but giving granular polarisation effects owing to minute dispersed crystals; well-marked flow-structure, often much contorted. The flow-structure is indicated by the alternation of clearer streaks of positive spherulitic material, with the browner more isotropic, and by broader bands, corresponding to those of a brownish colour in the hand-specimen, which consist of coarse irregular quartz mosaics, compact or cavernous, including fragmentary remains of brown biotite, and occasional leucoxene pseudomorphs after magnetite. A curious intergrowth is met with here between the quartz and a second colourless mineral, which frequently extinguishes like a spherulite—*i.e.*, gives a cross with four arms between *x.n.* The



No. 305/618. RHYOLITE WITH SPHERULITIC STRUCTURE.

[*To face p. 75, Vol. II.*



No. 306/626. BLACK MICROPŒCILLITIC HYPERSTHENE ANDESITE.

[*To face p. 75, Vol. II.*
ii.

r.i. of this mineral is high, so also its double refraction; and it is insoluble in cold hydrochloric acid. It looks very like a carbonate, and may be dolomite.

PHENOCRYSTS.—*Plagioclase:* Numerous crystals, usually broken, include apatite not uncommonly; *r.i.*, above balsam; ext., 22°/ 24°; zonal.

Quartz grains few, small.

Rhyolite, with spherulitic structure, containing plagioclase.

Illustration.—Slice shows fair contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which, owing to the varied character of the rest of the slice, cannot be considered characteristic of the whole.

Locality.—Creek-crossing, first on the Whangamata Road east of Omahu Peak, Thames County.

Formation.—Acid rocks of Pliocene age.

Remarks.—This rock comes from the west slope of the main range east of Omahu Peak, and the cavernous spherulitic structures resemble those of a like rock at the western base of the peak. These cavernous spherulites do not show radiform structure in the outer solid parts. In both cases these rocks lie contiguous to andesic rocks; in this case the andesites are of younger age and probably intrusive.

No. 306/626.

M.C.—Black basaltic-looking rock, with small phenocrysts.

U.M.—MATRIX about half the rock, perhaps less, minutely micropœcillitic; magnetite granules thickly scattered, probably conferring blackness on the rock; carbonates in clusters of granules; chlorite pseudomorphs; felspar laths rarely discernible.

PHENOCRYSTS.—*Plagioclase:* Abundant well-formed crystals and complexes, not very large, often highly zonal; ext., 27°/ 30°, 30°/ 30° (labradorite); mostly fresh; carbonates and mica beginning to appear.

Augite: Numerous large crystals and groups, almost colourless to faint-brown, twinned once or oftener, intergrown with hypersthene; ext., up to 41°; attacked by carbonates.

Hypersthene: Abundant pseudomorphs in green chlorite, with excreted magnetite.

Magnetite: Numerous large grains.

Black Micropœcillitic Hypersthene Andesite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper right, which is characteristic of the rest of the slice.

Locality.—Gloucester Claim, Karaka Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This rock is associated with altered indurated tuffs, often veined with calcite.

The specimen is of interest as being from the eastern part of the productive area of the goldfield within the valley of Karaka Creek.

No. 307/628.

M.C.—Green and purple breccia.

U.M.—The slice appears to pass only through the purple material.

MATRIX fine; granular polarisation due to alteration products; abundant felspar laths faintly indicated in pseudomorphs; chlorite scales, jagged quartz grains, leucoxene and magnetite granules present.

PHENOCRYSTS.—*Plagioclase:* Rather small crystals, largely converted into carbonates and mica, much torn out in grinding. Lamellar twinning preserved in some cases; ext., 12°/ 16°, 19°/ 20° (andesine).

Pyroxene represented by fairly numerous pseudomorphs of small crystals and fragments in chlorite of more than one species. Some of the pseudomorphs outlined by dark-brown iron-ores.

Magnetite: No large grains. In the matrix a great deal of the magnetite is collected in long skeleton prisms, which suggest the original presence of hornblende. Since, however, a dense accumulation of magnetite in the form of threads occurs about some obvious pyroxene pseudomorphs this may not have been the case.

Altered Pyroxene Andesite.

Locality.—Adelaide Claim, western lower slopes of Una Hill, Thames district.

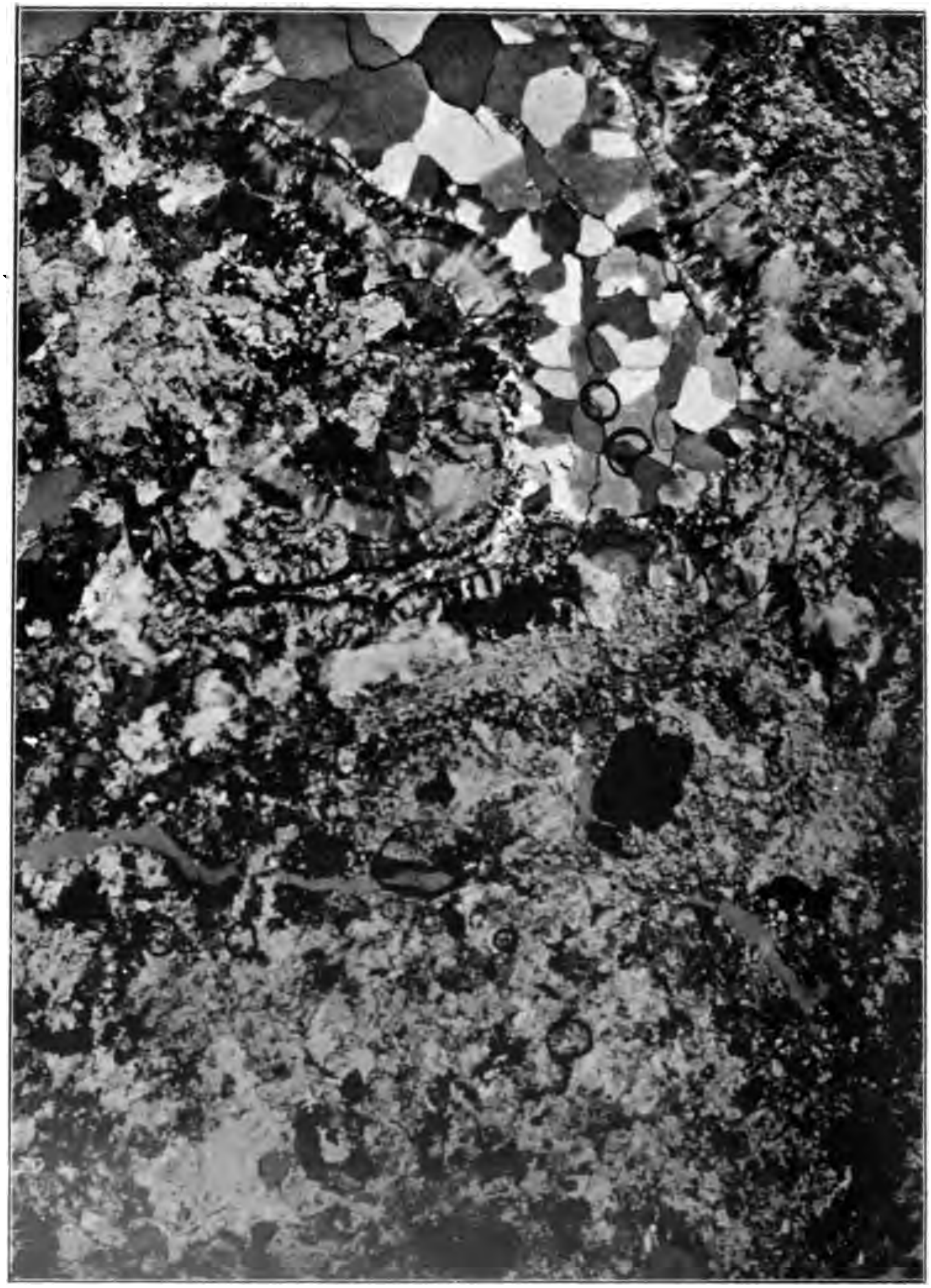
Formation.—Thames-Tokatea group.

Remarks.—This rock is in different specimens coarser or finer in grain. It trends along the western base of Una Hill, but as a green and purple breccia is not clearly traceable along Collarbone Gully, within which huge slips from higher ground may hide the outcrop of this rock, which should be present some distance up the gully.

No. 308/629.

M.C.—Green stony rock, with spots of chlorite, traversed by a quartz vein.

U.M.—No original structure preserved; carbonates with some chlorite form a great part of the rock, leaving irregular cavities, which have been completely filled with quartz. The quartz has grown in regular banded



No. 308/629. ALTERED ROCK.

[To face p. 77, Vol. II.

fibrous layers next the wall; the middle of the cavity is filled by a regular quartz mosaic. The banded layer may in places be represented by spherulitic growths, deceptively similar to those of a rhyolite. The carbonates occur partly as a mosaic of large crystalline grains, partly in a complex of quartz, chlorite, and calcite, forming a remarkable radiate growth. The chlorite occurs in patches in the carbonate, and is spotted through with quartz. Pyrites is present.

Completely replaced by carbonates and chlorite, with vesicles filled in with quartz.

Altered Volcanic Rock.

Illustration.—Slice shows moderate contrasts by ordinary light.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper middle part, which is characteristic of the lower middle part of the slice also, towards which the peculiarities of the slice extend.

Locality.—North Star Claim, Una Hill, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—The specimen is veined with thin leaders of quartz, but the slice shows none of these, and the "complex of quartz, chlorite, and calcite" was selected for illustration as the most remarkable part of the slice.

No. 309/631.

M.C.—Greyish-white decomposed rock.

U.M.—MATRIX minutely granular polarising small quartz granules, scattered leucoxene, and traces of micacised or kaolinised felspar laths.

PHENOCRYSTS.—*Felspar:* Fairly numerous crystals converted into carbonates. Species indeterminable.

Pyroxene represented by an occasional pseudomorph in chlorite and carbonates.

Quartz: One or two large grains only.

Ilmenite represented by leucoxene pseudomorphs.

Cannot be determined with certainty; possibly an **altered Dacite.**

Locality.—Gloucester Claim, upper part of Karaka Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—The specimen was taken from rock considered favourable for the occurrence of gold in quartz reefs that might intersect it. It is also an example of the alteration and decomposition that affects the better class of country on the Thames Goldfield.

No. 310/636.

M.C.—Black basalt-like rock, with abundant small phenocrysts.

U.M.—MATRIX micropœcillitic; felspar laths and small rectangles abundant in not very obvious stream-lines, scattered carbonates, chlorite, magnetite, and leucoxene granules. The magnetite is abundant. Here and there irregular patches of jagged quartz mosaic.

PHENOCRYSTS.—*Plagioclase:* Abundant crystals and fragments; *r.i.*, above balsam; ext., 18°/19°, 22°/22° (andesine); zonal. Inclusions central or submarginal, or both in the same crystal; consist of colourless glass, magnetite, and chlorite. Carbonates are beginning to appear; develop first in zones.

Augite: Fairly numerous large crystals, faint brownish-yellow, twinned, passing into carbonates.

· *Hypersthene* abundantly represented by pseudomorphs in serpentine, with which magnetite is associated.

Magnetite: Numerous large grains.

Black Hypersthene Andesite, with micropœcillitic matrix.

Illustration.—Slice shows moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which is characteristic of the rest of the slice.

Locality.—Top of Una Hill (900 ft.). Thames Goldfield, Thames County.

Formation.—Thames-Tokatea group.

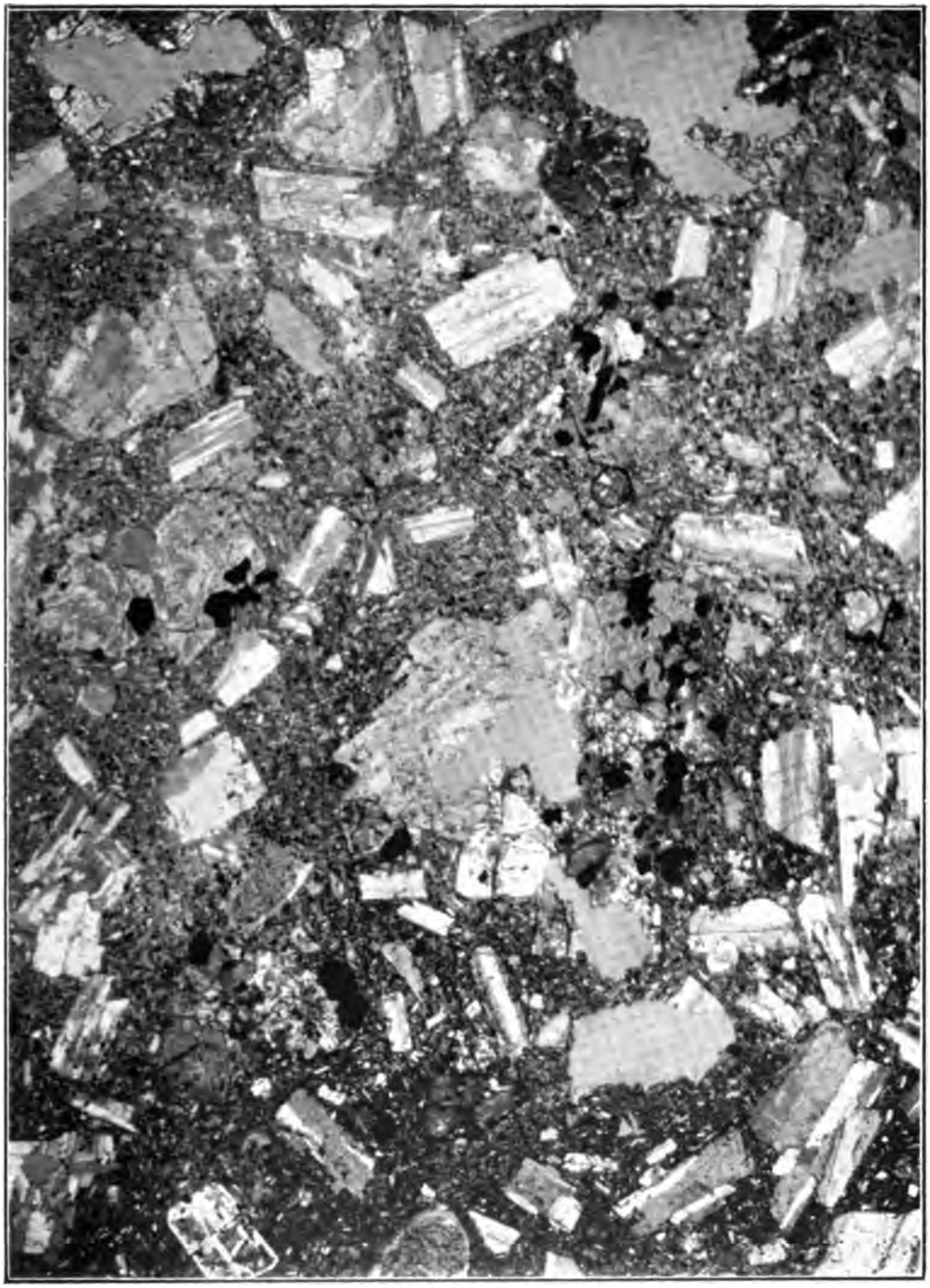
Remarks.—Occurs as a hard patch surrounded by soft altered or decomposed rock. This has been considered typical, and quoted as an example of the manner in which the rocks of the Thames Goldfield have been and are being affected by alteration and decomposition—leaving hard bars between softer decomposed country. Sometimes, and by some writers always, these harder undecomposed rocks are regarded as dykes.

No. 311/637.

M.C.—Purplish stratified tuff, with evidence of pressure (close, oblique jointing).

U.M. — Composed of angular and irregular fragments of rocks and minerals of very various size, but never large, the smallest fine indeterminable dust; no "bone"-like tuff fragments are present. Ferric hydrate contributes to interstitial material.

The material is chiefly basic, the fragments of rock mostly different varieties of andesite, some black with iron-ores, and containing small vesicular cavities now filled with chlorite and carbonates; some light-coloured, spotted with dendrite-like patches of leucoxene, and crowded with altered felspar microliths in stream-lines; some micropœcillitic. The minerals are altered



No. 310/636. BLACK MICROPŒCILLITIC HYPERSTHENE ANDESITE.

[To face p. 78, Vol. II.

plagioclase and pyroxene, chiefly represented by pseudomorphs in chlorite and quartz, though a little fresh augite occurs. Quartz does not occur in large primary grains, but secondary quartz is present, and a little epidote.

Volcanic (ANDESITIC) Tuff.

Locality.—Higher part of the western face of Una Hill, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This rock is clearly stratified in nearly horizontal layers, but a little to the south of the locality of the specimen there is a cleft in the side of the hill showing a nearly vertical reef-formation. The sides of the fissure are formed of the rock here described in an indurated and altered condition, having assumed a flaggy structure parallel to the reef and nearly at right angles to the bedding planes of the rock at the place where the specimen was taken.

No. 312/649.

M.C.—Light-grey rock, with numerous small phenocrysts of felspar and ferro-magnesian minerals.

U.M.—MATRIX formed of jagged or lobate irregular granules of quartz, with some felspar laths and rectangles, an occasional crystal of augite, numerous granules of magnetite of various size, and a good deal of colourless chlorite.

The matrix may make half the rock, but it is difficult to draw a line between matrix and phenocrysts, owing to the gradation in size between the felspar crystals, which may be regarded as belonging to the matrix and the phenocrysts respectively.

PHENOCRYSTS.—*Plagioclase:* Abundant small crystals and clusters, irregular growth, and irregular twinning; ext., 23° / 26°, 27° / 32° (andesine–labradorite). The crystals are frequently cavernous, not wholly as a result of grinding, and are undergoing change. Carbonates are occasionally present, but the more common alteration is into a substance which differs in appearance from the felspar chiefly by possessing a lower refractive index; its double refraction is not lower. It develops more frequently in the core than the exterior of the crystal. It also follows bands of zoning, and runs in irregular veins.

Radio-fibrous growths of a colourless alteration product sometimes occur.

Augite: Fairly numerous small crystals, very pale greenish-brown in the interior, becoming darker yellowish-brown towards the margin, not pleochroic; ext., up to 45°. In some examples an hour-glass structure is revealed between *x.n.* The outer darker margin ext. at a lower angle than the central portion by as much as 6°. A black border of magnetite or associated magnetite is of frequent occurrence.

Hypersthene: Numerous pseudomorphs in chlorite, and sometimes carbonates bounded by a deep border of magnetite and penetrated by threads of magnetite occur, and may represent hypersthene or augite, more probably the former.

Hornblende: One or two large resorption pseudomorphs, and some few smaller ones.

Grey Hypersthene Hornblende Andesite.

Locality.—Hape Creek, Thames Goldfield and County.

Formation.—Thames-Tokatea group.

Remarks.—The Hape Creek breccias lie upon the south-east border of the auriferous area of the Thames Goldfield, and by some geologists are regarded as the equivalent of the Tararu Creek breccias (those showing on the shore of the gulf between the mouth of the creek and Rocky Point are here meant). The latter are, undoubtedly, at the base of the volcanic accumulations, but it cannot be shown conclusively that the Hape Creek breccias occupy the same horizon.

No. 313/656.

M.C.—Grey-white rock, with large white felspar phenocrysts and scattered pyrites.

U.M.—MATRIX shows as a mosaic of irregular quartz grains, dusty with mica and kaolin, with traces of felspar laths and rectangles as mica pseudomorphs, and scattered granules of leucoxene.

PHENOCRYSTS.—*Plagioclase* represented by numerous large pseudomorphs, preserving the original crystal outlines of the felspar, and consisting of mica, kaolin, and carbonates; some chlorite and quartz are also present.

Pyroxene: Some small pseudomorphs in mica or kaolin filled with leucoxene granules may represent pyroxene.

Quartz: Several rounded and corroded grains.

Pyrites generally distributed; some occur within the felspar pseudomorphs.

A much-altered rock; may have been a **Dacite** originally.

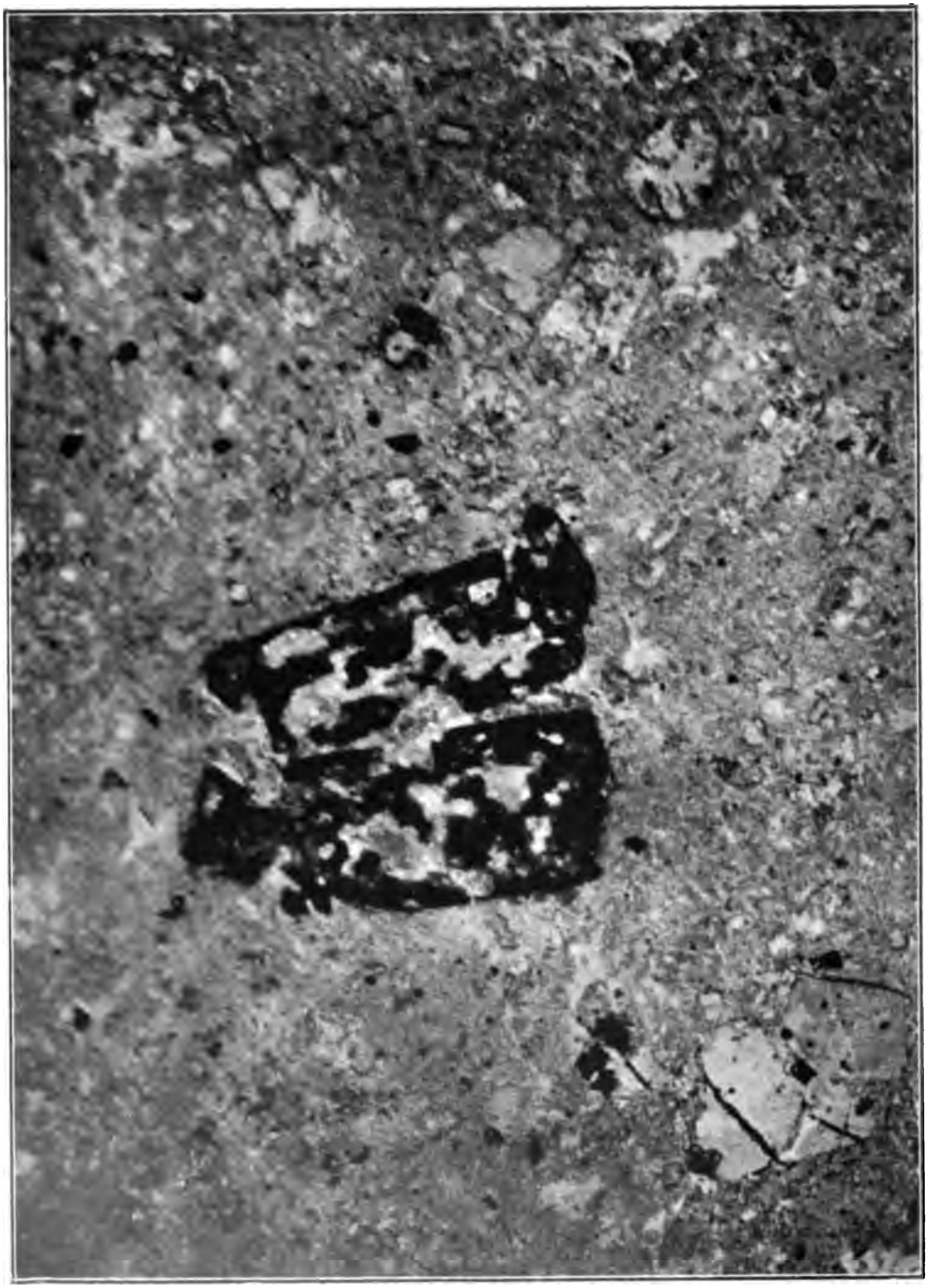
Locality.—The northern end of Tararu Beach, near Rocky Point, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—The sample is from the formation known as the Tararu Creek breccias and from the lower part of their development on the coast-line, but the specimen was taken from what appeared a solid bed of volcanic rock, the bulk of the breccias overlying this.

No. 314/658.

M.C.—Greenish, compact, decomposed rock, with chloritic pseudomorphs.



No. 314/658. DECOMPOSED HORNBLENDE PYROXENE ANDESITE.

[To face p. 81, Vol. II.

U.M.—MATRIX: Granular polarisation due to mica, kaolin, and chlorite; jagged quartz grains, and pseudomorphs after felspar laths; carbonates in patches. Felspar laths in stream-lines. Scattered leucoxene granules.

PHENOCRYSTS.—*Felspar:* Numerous but not very large pseudomorphs, chiefly in carbonates, with some mica.

Pyroxene represented by numerous pseudomorphs, often unusually large, composed of chlorite (pennine), carbonates, and a little leucoxene.

Hornblende: Numerous resorption pseudomorphs, frequently of great size, composed of granular material, brown by transmitted and white by reflected light; quartz in longitudinally striated mosaics; carbonates, which especially occur in the reaction border.

Magnetite converted with leucoxene.

Decomposed Hornblende Pyroxene Andesite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower middle, which is characteristic of the whole slice.

Locality.—Head of water-race between the main branches of Karaka Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This rock corresponds in position and character with the greenish rocks of the middle part of Tararu Creek.

No. 315/662.

M.C.—Black basaltic-looking rock, with abundant small phenocrysts.

U.M.—MATRIX: *Felspar* laths and rectangles in stream-lines, interstitial grains and prisms of altered augite, granules of magnetite, irregular quartz grains; but for the quartz very basalt-like in character. Micropœcillitic in places.

PHENOCRYSTS.—*Plagioclase* abundant, not very large crystals, coarsely twinned; ext., 31°/34° (labradorite); mostly rectangular sections; mostly fresh, but mica beginning to appear; in some whole central area highly micacised and marginal zone absolutely unaffected, the two regions sharply delimited.

Augite: Numerous crystals, clusters, and intergrowths, faint-green in colour; ext., up to 42°; sometimes enclose hypersthene. Twinning common; worthy of detailed study.

Hypersthene crystals about as numerous as those of augite, fresh, usual pleochroism.

Magnetite: Rather numerous large grains, especially in association with pyroxene.

Black Hypersthene Andesite.

Locality.—Upper part of Karaka Creek, Thames district.

Formation.— Thames-Tokatea group.

Remarks.—The specimen comes from the main valley a short distance above where the principal branch makes junction with Karaka Creek. It corresponds in character with, as in position it agrees with that of, the rocks forming the peak east of Una Hill, from which the hade of the lava-stream down the side of the range would bring it to where the specimen was collected.

Locality.—Upper part of Karaka Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—The specimen comes from a little above the junction of the first stream from the east after passing through the gorge. The rock here is probably the same lava-stream that appears on the range between Karaka and Hape Creek one mile east of Una Hill, the dip of which being to the eastward it should again be met with in the low grounds of the valleys of the creeks named.

No. 316/670.

M.C.—Greyish-green rock, with small white felspar phenocrysts and ferromagnesian minerals.

U.M.—MATRIX abundant, more than half the rock, granular polarising material, probably altered glass, felspar laths and rectangles, often eviscerated of felspar by chlorite, quartz in jagged grains, chlorite, and magnetite grains.

PHENOCRYSTS.—*Plagioclase* in fairly numerous rather large crystals and complexes; much altered in zones, corresponding probably to glass-inclusions; elsewhere fresh, margin generally so, centre often decomposed. Muscovite, chlorite, quartz, and carbonates may be present. Some crystals quite fresh and almost free from inclusions.

Pyroxene: Numerous pseudomorphs in green chlorite, but the mass of these is small compared to the quantity of green material dispersed through the slice.

Hornblende: Numerous resorption pseudomorphs now consisting of chlorite, quartz, magnetite, and leucoxene.

Magnetite: Numerous grains, not very titaniferous.

Altered Hornblende Pyroxene Andesite.

Illustration.—Slice shows moderate contrasts.

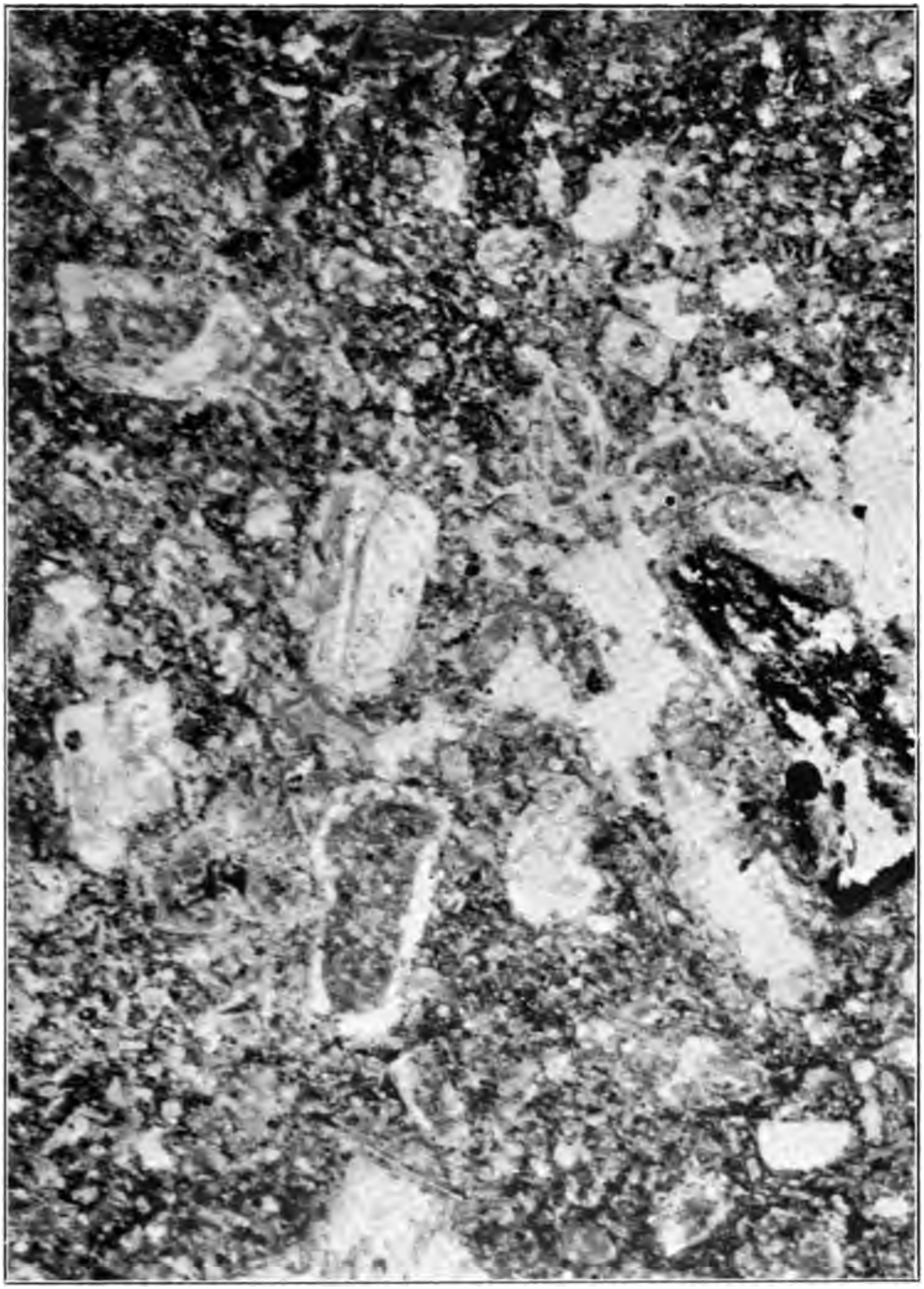
Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which is characteristic of the whole slice.

Locality.—Hape Creek, Thames district.

Formation.—Thames-Tokatea group.

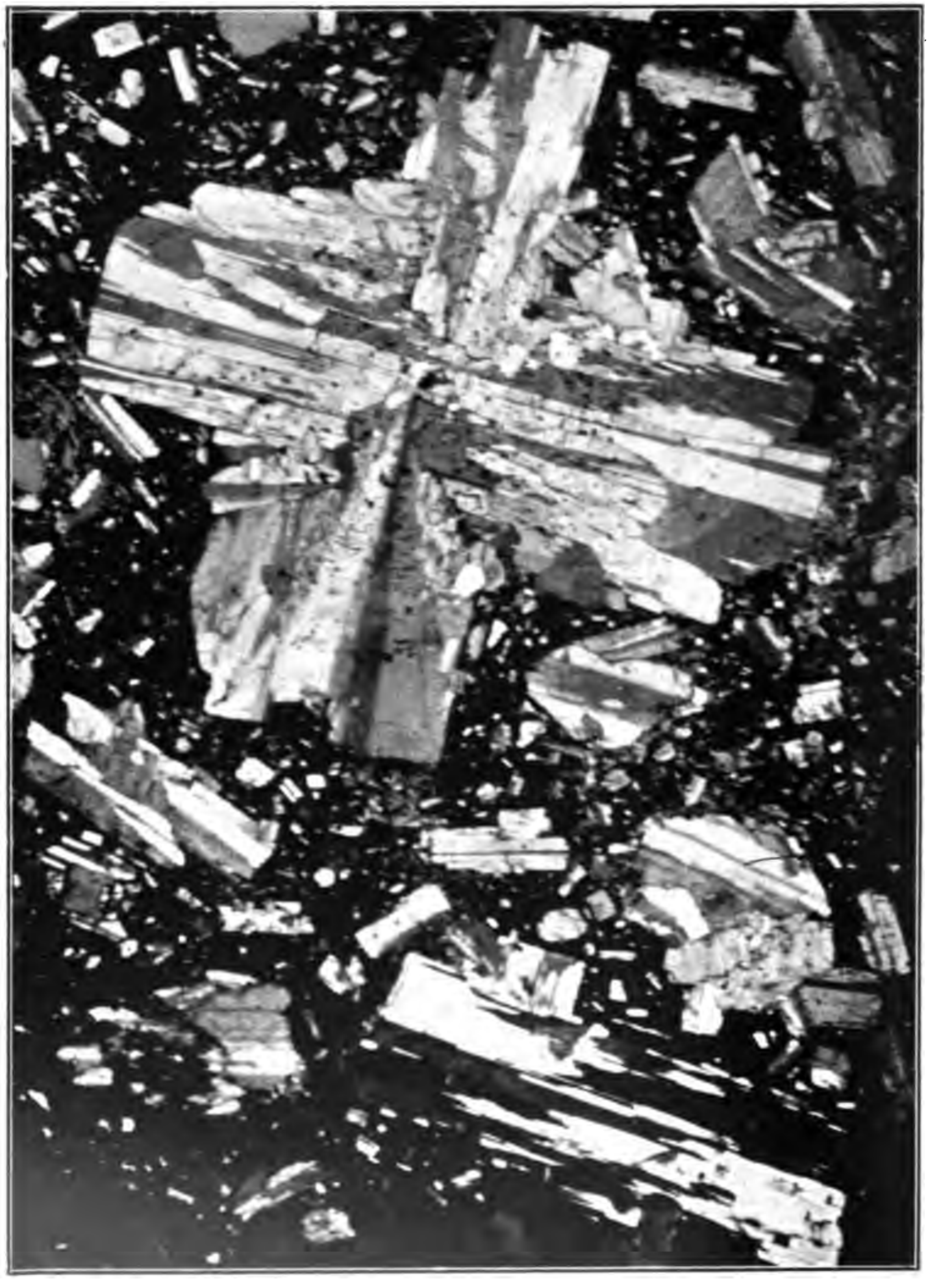
Remarks.—This is the rock next overlying the Hape Creek breccias. It is overlain by a dark and much-coarser porphyritic rock.

No. 316/670.



No. 316/670. ALTERED HORNBLENDE PYROXENE ANDESITE.

[To face p. 82, Vol. II.



No. 317 671. BLACK HYPERSTHENE ANDESITE.

[To face p. 83. Vol. II.

No. 317/671.

M.C.—Black basalt-like rock, with small phenocrysts.

U.M.—Matrix in places micropœcilitic; in places a little granular brown glass survives? felspar in laths and rectangles, with not very obvious flow-arrangement; occasional augite grains; abundant octahedra of magnetite.

Phenocrysts.—*Plagioclase* of usual andesitic habit; ext., 20°/20°, 27°/30° (andesine–labradorite); much of the felspar rather free from inclusions, some crystals rich in them; brown glass and colourless glass with magnetite are present.

Augite: Chiefly in somewhat small crystals clustered together, or glomeruloporphyritic with plagioclase, faint bluish-green in colour.

Hypersthene fresh, in separate crystals and associated with augite; usual pleochroism; probably equal quantities of hypersthene and augite, also forms glomeruli with equidimensional crystals of plagioclase.

Black Hypersthene Andesite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper right, which includes a very remarkable compound crystal, being two of the same kind and size crossing at right angles to each other. Twinning is prominent in this and other phenocrysts and lesser crystals of the slice, as shown in the reproduction.

Locality.—Main source branch of Hape Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—Comes from a prominent dyke-like outcrop near the junction of the two branches of the creek.

No. 318/675.

M.C. — Purplish rock, with white felspar crystals and altered ferro-magnesian minerals.

U.M.—Matrix composed of irregular quartz grains, micacised felspar laths and rectangles, carbonates, magnetite, and rods of black iron-ore oxidizing reddish-brown. These last probably represent vanished ferro-magnesian minerals; they run with the felspar pseudomorphs in stream-lines.

Phenocrysts.—*Felspar:* Numerous well-formed crystals, not very large, much altered by development of muscovite and carbonates. Some retain traces of albitic twinning, and parallel extinction, but many present no signs of twinning. Plagioclase was evidently present, but orthoclase is not included.

Pyroxene represented by fairly numerous somewhat large pseudomorphs in chlorite and carbonates, chiefly the latter; cracks in the pseudomorphs filled with ferric hydrates.

Magnetite is present.

Highly altered; probably originally **Hypersthene Andesite.**

Illustration.—Slice shows but moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which is characteristic of the whole slice.

Locality.—Adelaide Claim, west slope of Una Hill, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—From the low-level tunnel, in which green and purple breccias are for some distance from the entrance the principal rock.

No. 319/678.

M.C.—Bluish greenish-grey rock, with small phenocrysts.

U.M.—Matrix: Abundant chlorite, in which lie immersed pseudomorphs of felspar laths and rectangles, irregular grains of quartz, scattered leucoxene granules, and carbonates.

Phenocrysts.—*Plagioclase:* Numerous pseudomorphs in carbonates and muscovite, with some chlorite and quartz; where fresh felspar-substance remains it sometimes shows synthetic twinning; ext., 6°/ 7°. The prevalence of carbonate as the replacing material suggests that the prevalent felspar was plagioclase (soda-lime).

Pyroxene represented by fairly large and numerous pseudomorphs in green chlorite (pennine), with carbonates and associated leucoxene. Some chiefly in carbonates, or carbonates and quartz.

Ilmenite represented by large plates bordered by brownish leucoxene.

Altered Andesite; probably **Hypersthene Andesite.**

Locality.—Gloucester Claim, Karaka Creek, Thames district.

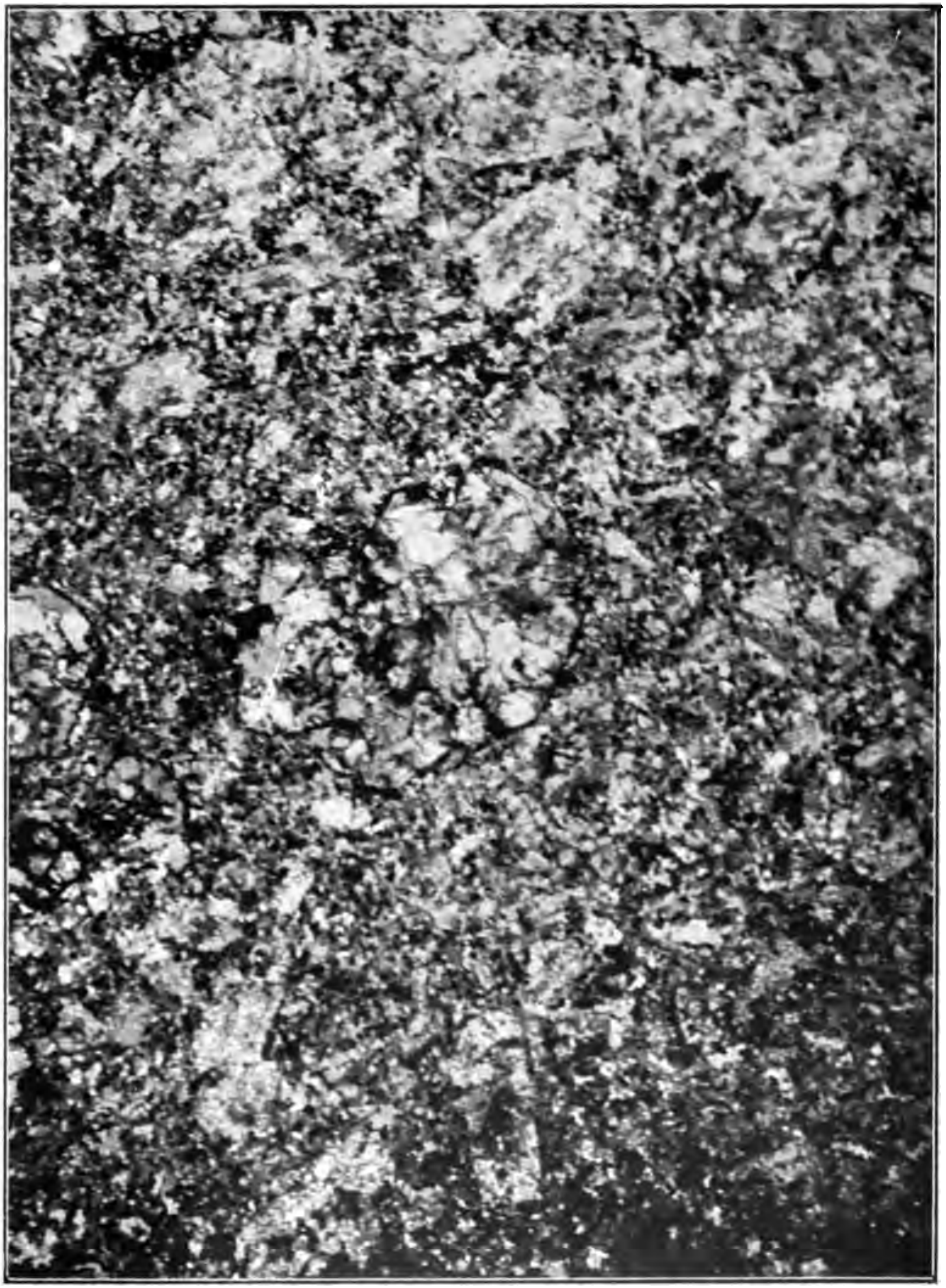
Formation.—Thames-Tokatea group.

Remarks.—A considerable proportion of the "spoil" from this mine is of a fragmental character. In this instance the slice has been taken from what may be considered a solid rock, neither the specimen nor the slice giving indications of a fragmental character.

No. 320/679.

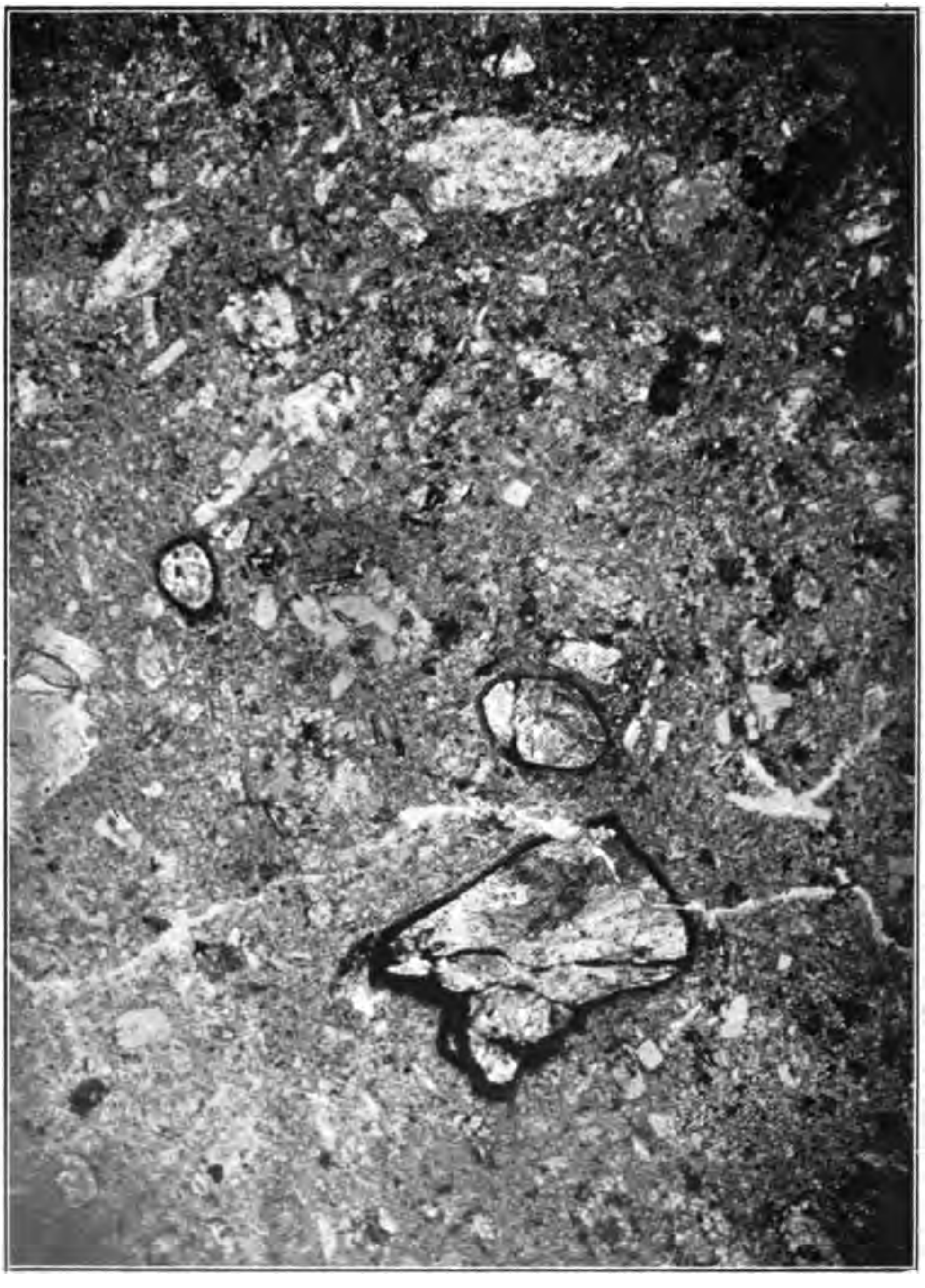
M.C.—Bluish-grey, compact rock, without evident phenocrysts.

U.M.—Matrix formed of pseudomorphs of minute felspar laths crowded in stream-lines, chlorite, carbonates and scattered leucoxene granules. Quartz is not visible.



No. 318/675. HIGHLY ALTERED HYPERSTHENE ANDESITE.

[To face p. 84, Vol. II.



No. 320/679. ALTERED HORNBLENDE PYROXENE ANDESITE.

[*To face p. 85, Vol. II.*

PHENOCRYSTS.—*Felspar* represented by fairly numerous but rather small pseudomorphs in carbonates and muscovite, with some chlorite. Species indeterminate, but excess of carbonate suggests plagioclase.

Pyroxene: Numerous small pseudomorphs in chlorite (pennine); others generally larger in carbonates, or carbonates and chlorite; probably these represent both augite and hypersthene.

Hornblende: Numerous large resorption pseudomorphs now converted into carbonates, with a little chlorite; the reaction border consisting chiefly of granular material, white by reflected and brown by transmitted light, arranged in fibres normal to the surface, like a fringe.

Altered Hornblende Pyroxene Andesite.

Illustration.—Slice shows moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which is generally characteristic of the whole slice.

Locality.—Gorge of Karaka Creek (lower end), Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This is one form of "miners' sandstone." The rock rests on or follows the green and purple breccias of the low tunnel in the Adelaide Claim, and is well seen in the horse-track at the entrance to the gorge.

No. 321/682.

M.C.—Green serpentinous(?) rock, matrix crowded with small white phenocrysts pseudomorphous after felspar.

U.M.—MATRIX greenish serpentinous material, probably derived from basic glass, with small rectangles of felspar, once or twice twinned; and grains of magnetite. Vesicular portions occur lined with green fibrous serpentine or chlorite, and filled in with brown granular material, which is white by reflected light.

PHENOCRYSTS.—*Felspar* of very uniform size in well-formed crystals, but now converted for the most part into kaolin; unaltered fragments remain; these show lamellar twinning and extinction at 8°/8°, 12°/14°, with *r.i.* above balsam. They are therefore andesine.

Pyroxene is represented by pseudomorphs in chlorite or serpentine.

Magnetite is present in large grains, and it is partly owing to the presence of these, as well as the softness of the rock, which can be cut with a knife, that the lapidary has not succeeded in obtaining good slices.

Altered Andesite (?).

Locality.—Deep Sinker Claim, Thames district.
Formation.—Thames-Tokatea group.
Remarks.—From about the 500 ft. level in the shaft, and overlying a much softer rock, No. 687, yet to be described.

No. 322/687.

M.C.—Greenish-grey decomposed rock, with soapy feel, and crowded with pseudomorphous phenocrysts of felspar.

U.M.—MATRIX, like the rest of the rock, completely kaolinised; felspar laths were present in abundance; leucoxene now marks their outlines, and possibly those of augite and hypersthene also. Magnetite still survives, but with a margin of leucoxene. The matrix makes about half the rock, perhaps less. Irregular areas, like infilled vesicles, occur, lined with some fibrous alteration product, and filled in with fine granular material.

PHENOCRYSTS.—*Felspar:* Abundant well-formed zonal crystals completely kaolinised.

Pyroxene converted into colourless alteration products, possibly serpentine and chlorite. It sometimes presents the same irregular vesicular appearance as the matrix; this may result from the manner of replacement, and may therefore not indicate an originally vesicular character. From the form of the sections it would appear that hypersthene was present as well as augite.

Magnetite: A good deal is irregularly scattered through the slice; may have resulted from alteration processes.

This is a good instance of atmospheric weathering—*i.e.*, of alteration by percolating subterranean waters, uncomplicated by siliceous infiltrations.

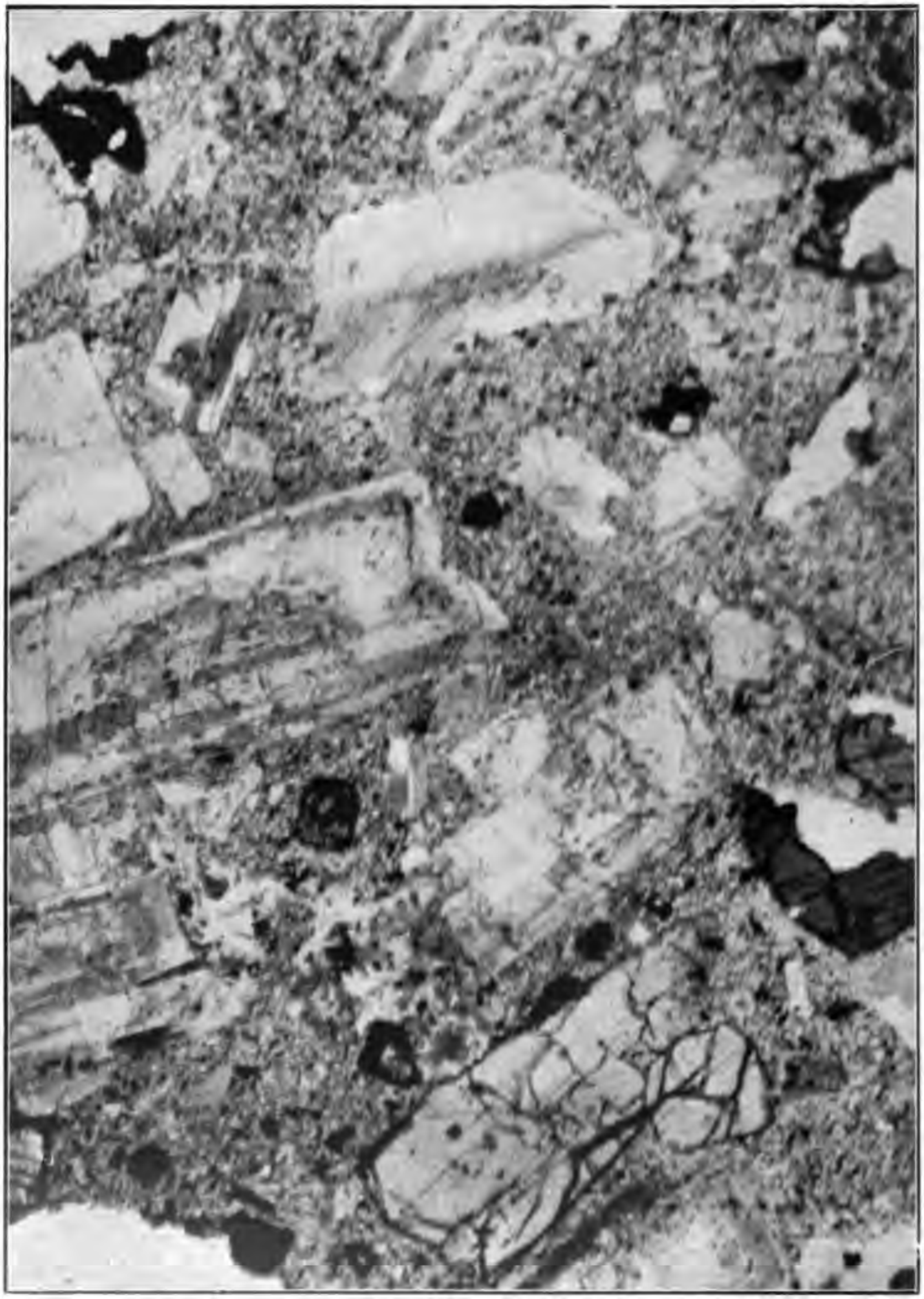
Altered Andesite.

Locality.—Shaft of the Deep Sinker Mine, Thames Goldfield and County.
Formation.—Thames-Tokatea group.
Remarks.—This is the same as was referred to under specimen No. 682. In the locality whence it comes there are no surface indications of the former existence of thermal springs, and it is therefore unlikely that the waters of such have brought about the peculiar condition of this rock. The specimen came from fully 500 ft. below sea-level, and this fact may be considered in connection with the suggested "alteration by percolating subterranean waters."

No. 323/692.

M.C.—Black basalt-like rock, with abundant small phenocrysts.

U.M.—MATRIX sparingly micropœcillitic, crowded with plagioclase laths in stream-lines, serpentinous pseudomorphs after pyroxene, and abundant magnetite granules.



No. 323/692. BLACK HYPERSTHENE ANDESITE.

[*To face p. 87, Vol. II.*

PHENOCRYSTS.—*Plagioclase:* Abundant, sections mostly rectangular, the long axis running with the stream-lines; ext., 23°/ 24°, 29°/ 36°, 25°/ 25° (andesine–labradorite). Some almost free from inclusions, some crowded with them, except in the marginal zone. Inclusions comprise pyroxene, green decomposition products, magnetite, and colourless crystalline material in negative crystals.

Augite: Fairly numerous well-formed crystals, both large and small, faint-greenish tint, ext. up to 45°, include magnetite.

Hypersthene: Usual pleochroism, passing into serpentine and carbonates; about equal in quantity to the augite.

Magnetite: A good deal.

Quartz and *chlorite* associated in patches.

Black Hypersthene Andesite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle left, which is characteristic of the rest of the slice.

Locality.—Quarries, Hape Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This rock is extensively quarried for road-metal, &c.

No. 324/696.

M.C.—Purple compact rock, porphyritic, with numerous large phenocrysts of felspar and hornblende.

U.M.—MATRIX about half the rock; abundant irregular grains of quartz form greater part of the matrix; chlorite scales, magnetite, an occasional zircon, and some epidote also present.

PHENOCRYSTS.—*Plagioclase:* Numerous large crystals and complexes; lamellar twinning; ext., 6°/ 6°, 15°/ 15°, 13°/ 20° (oligoclase–andesine, andesine); *r.i.*, above balsam. A colourless mineral has replaced a good deal of the plagioclase. The double refraction of this mineral is somewhat higher than that of the plagioclase; its *r.i.* much lower.

Inclusions of *epidote* and *carbonates.*

Pyroxene: Pseudomorphs in epidote and chlorite; a little quartz and associated iron-ores, the former bordered by a zone of iron-ore in some cases. Pseudomorphs not very numerous.

Hornblende: Large and numerous resorption pseudomorphs in iron-oxide, and chlorite, with included pseudomorphs after pyroxene in epidote, and excreted apatite.

Quartz : Numerous highly corroded grains.

Apatite : Large rather short and broad yellow-brown crystals, longitudinally striated, pleochroic, sometimes with a colourless central core.

Magnetite : Numerous large grains.

Hornblende Pyroxene Dacite.

Locality.—The siphon on water-race, Tararu Creek, below junction of Tinker's Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—The specimen is from a thick band of breccia at the point where the water-race is siphoned across the road on the left bank of the creek. This breccia is not like, nor does it occur in the same horizon as, the Tararu breccias. These latter rest on sedimentary rocks of Carboniferous age or the felsite tuff of Rocky Point, and are varied in structure and character. The fragments which make up the breccias, of which No. 696 (the specimen described) is an example, is a coarsely porphyritic rock, which, as considerable-sized fragments, is imbedded in a green matrix, neither which nor the breccia fragments look like decomposed rocks. This occupies a higher position than the Tararu breccias, and along the valley of Tararu Creek there are other thick bands of coarse or fine breccias, so that the Tararu breccias are only the best-known of a series of such developments that appear near the top, in the middle part, and at the base of the Thames-Tokatea group.

No. 325/699.

M.C.—Greenish-grey lustreless rock, with scattered felspar phenocrysts. Darker patches occur in the rock.

U.M.—MATRIX much altered; kaolinised, but structure retained sufficiently to show that felspar laths were abundantly present, and they are bordered by rods of dark iron-oxide; quartz grains, minute, jagged, and irregular, are generally disseminated. Some of the iron-oxide follows the outlines of small ferro-magnesian prisms. Carbonates occur here and there.

PHENOCRYSTS. — *Plagioclase :* Abundant well-formed crystals, but much altered, chiefly into carbonates, but also into epidote and some mica-like mineral. Some crystals retain sufficient felspar to determine the extinction, which was found to be 20°/23°, 21°/30° (andesine, andesine–labradorite).

Pyroxene represented by numerous pseudomorphs in green chlorite. A good deal of magnetite is associated with these.

Ilmenite : Several characteristic plates passing into leucoxene.

Altered Andesite.

Are the darker patches somewhat differently (*i.e.*, less) altered than the remainder; or are they xenoliths? The slice would suggest the former alternative. They might be streaks originally richer in iron.

Locality.—Road-metal quarry immediately below junction of Tinker's Creek, Tararu Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This rock may be considered the equivalent of the breccia beds at the western base of Una Hill, on the Adelaide Claim. Here the rock is uniformly grey, never purplish as within Karaka Creek watershed.

No. 326/703.

M.C.—Pale-greenish rock, crowded with xenoliths.

U.M.—Thoroughly decomposed. The xenoliths are rounded and angular. Some appear to have been dacite; they consist of a matrix of not very fine-grained mosaics of quartz, containing pseudomorphs, after felspar in carbonates and epidote, after pyroxene in chlorite and epidote, after ilmenite in leucoxene, and they contain numerous highly corroded quartz grains. Other dacites in the slice differ from these in possessing a much finer-grained matrix, the quartz being in minute granules with interspersed kaolin. Fragments of matrix occur which may have been dacite, but which offer no diagnostic characters. The interstices between the fragments are sometimes filled with chlorite in radio-fibrous growth, also with colourless or faint-yellow epidote, and carbonates. A few fragments are sedimentary, and resemble grauwacke. Pyrites is scattered here and there.

A fine-grained breccia composed chiefly of fragments of dacite: **Dacite Breccia.**

Locality.—Upper part of Tararu Creek, half a mile lower down the valley than the Chicago Reef Mine, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This is a breccia finer in the grain than such rocks usually are. It is the highest of the five breccia bands noted between the Chicago reef and the mouth of the creek, within which space five prominent bands of breccia may be observed.

No. 327/705.

M.C.—Greyish-green compact rock, with phenocrysts of felspar and ferro-magnesian mineral.

U.M.—MATRIX: Felspar only rarely as laths, mostly as small repeatedly twinned rectangles. Quartz in ragged grains. Chlorite as pseudomorphs after pyroxene and frequently interstitial, leucoxene, and sometimes epidote and carbonates.

PHENOCRYSTS.—*Plagioclase:* Abundant well-formed crystals and clusters, for the most part fresh, with only a few specks of carbonates and epidote, but some largely replaced by these minerals and chlorite; ext., 20°/25°, 22°/27° (andesine).

Pyroxene: Numerous pseudomorphs of well-formed fairly large crystals in green chlorite (pennine), with much associated iron-ore and leucoxene; some contain patches of carbonates and quartz mosaic. Here and there pseudomorphs composed entirely of quartz mosaic occur.

Hornblende: A few resorption pseudomorphs.

Ilmenite was abundant, now represented by plates of leucoxene.

No primary quartz grains, but a large fragment of quartz is visible in the hand-specimen.

Altered Andesite, containing hornblende.

Locality.—Tararu Creek, opposite the Sylvia battery, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—The specimen is from a thick flow of volcanic rock, under- and overlain by beds of breccia material.

No. 328/709.

M.C.—Greyish-black compact rock, crowded with small phenocrysts of felspar.

U.M.—MATRIX composed of rather coarsely micropœcillitic quartz, also ragged quartz grains; a few altered felspar laths, but felspar mostly in small rectangles; a good deal of chlorite, disseminated iron-ores, and leucoxene; a little epidote.

PHENOCRYSTS.—*Plagioclase:* Numerous rather small crystals and clusters, some quite fresh, others containing carbonates, epidote, chlorite, and quartz. Poor in inclusions, some with zones of negative crystals filled with transparent material and magnetite; ext., 27°/29°, 27°/33° (andesine–labradorite).

Pyroxene: Many small pseudomorphs, and some larger, in green chlorite (pennine), with associated leucoxene and apatite; carbonates in some.

Hornblende: Numerous pseudomorphs in chlorite with scattered leucoxene granules, some with carbonates in the centre, resorption zones rare.

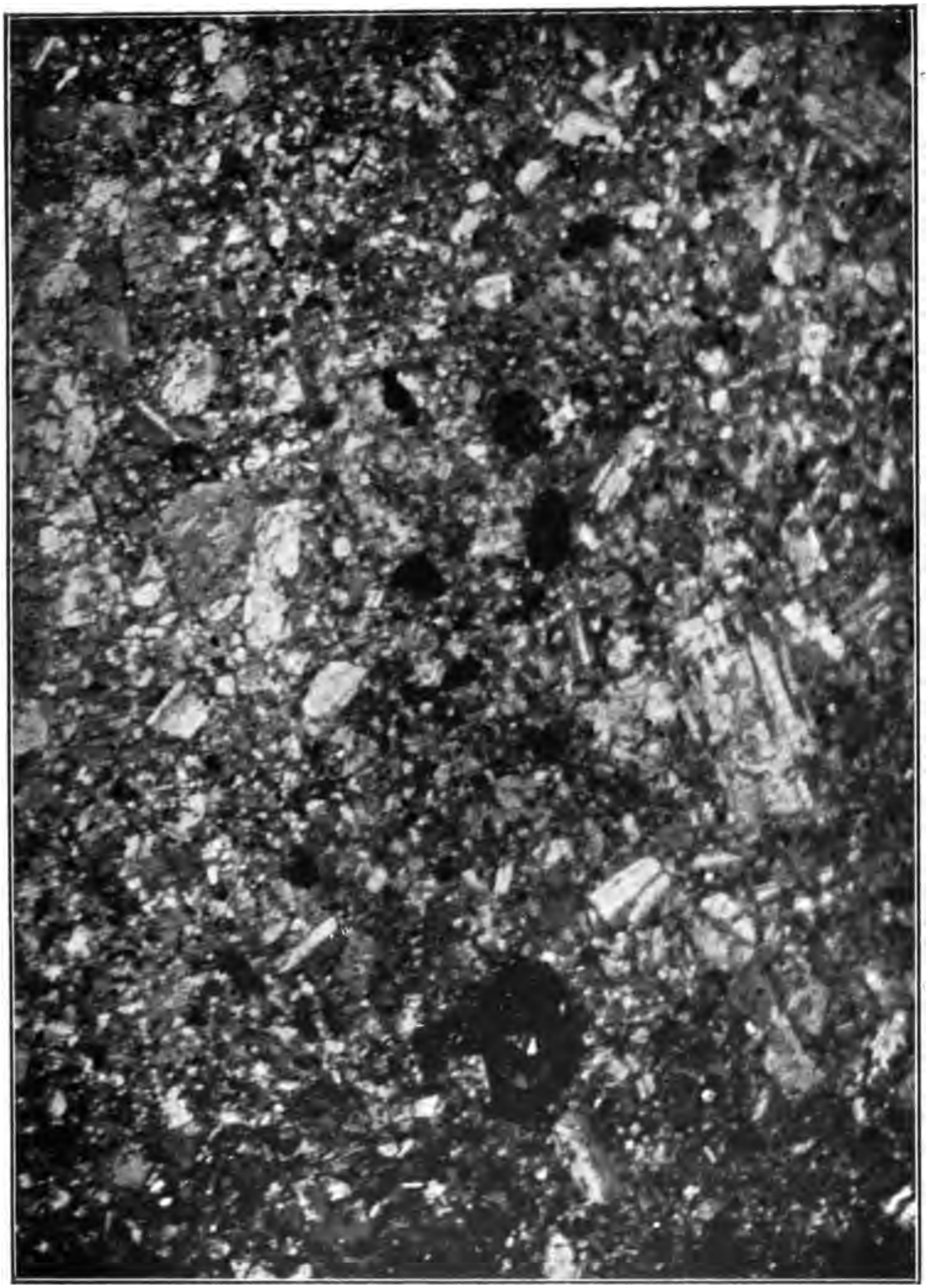
Titaniferous iron-ore and *leucoxene* fairly abundant.

There are no primary grains of quartz, and thus the rock is

Hornblende Pyroxene Andesite.

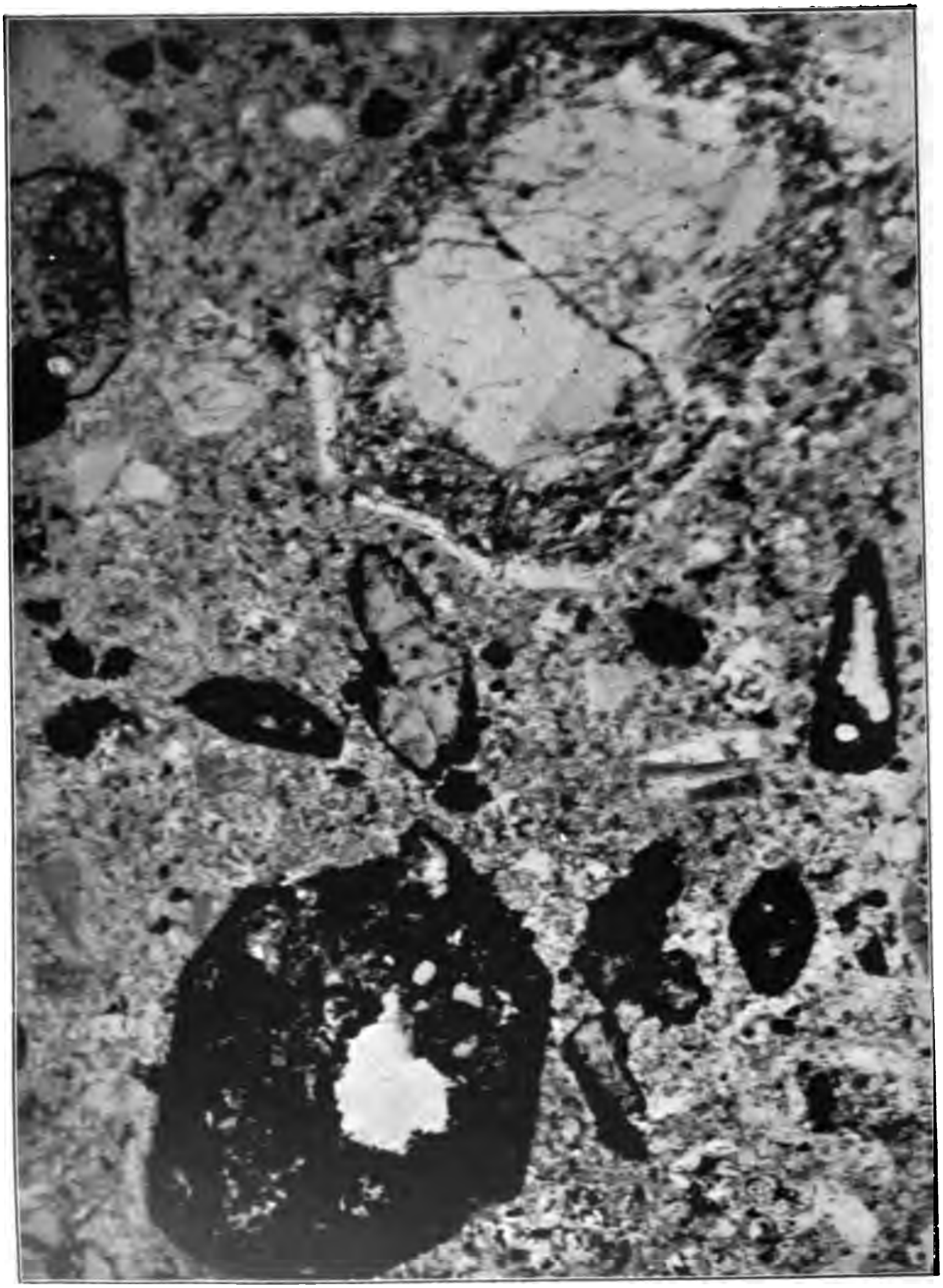
Illustration.—Slice shows but medium contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower left, which is characteristic of the whole slice.



No. 328/709. HORNBLENDE PYROXENE ANDESITE.

[To face p. 90, Vol. II.



No. 329/712. PYROXENE HORNBLENDE DACITE.

[To face p. 91, Vol. II.

Locality.—Second crossing of Tararu Creek (going upstream), Thames Goldfield and County.

Formation.—Thames-Tokatea group.

Remarks.—This rock is well exposed in the road-metal quarry on the downside of the creek-crossing. It has the appearance of a dyke, though the walls and selvages cannot be distinctly traced. The fine grain of this rock is shown in the illustration, the crystals with one or two exceptions, and these are not large, being small.

No. 329/712.

M.C.—Fragment of purple rock, compact, and which contains numerous large phenocrysts of felspar and hornblende in a green matrix. The slice only passes through a part of the fragment, and does not show the matrix.

U.M.—MATRIX consists of irregular quartz grains and minute dusty bi-pyramids, also sometimes micropœcillitic. Chlorite, and felspar laths rarely visible. Minute granules of magnetite, and rods representing some vanished ferro-magnesian mineral.

PHENOCRYSTS.—*Plagioclase :* Abundant crystals, complexes, and fragments, fresh, but with inclusions, which may be central or zonal, altered; ext., 22° / 25° (andesine).

Pyroxene represented by fairly numerous well-shaped pseudomorphs in chlorite, carbonates, with quartz in transverse cracks, bounded by black iron-oxide. Pseudomorphs contain magnetite; probably some were hypersthene.

Hornblende : Numerous resorption pseudomorphs, both large and small. Pyroxene pseudomorphs occur in association with these.

Quartz : Fairly numerous corroded grains and bi-pyramids.

Magnetite and *apatite* not uncommon.

Pyroxene Hornblende Dacite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower right, which is fairly characteristic of the rest of the slice. The reproduction shows clearly two remarkable phenocrysts, that in the upper part of the slice being distinguished by a very broad border, the outer margin of which, like the middle part of the crystal, is nearly white.

Locality.—Tararu Creek, at the siphon on water-race below junction of Tinker's Creek, Thames Goldfield and County,

Formation.—Thames-Tokatea group.

Remarks.—This is from a coarse breccia separated from the Tararu Creek breccias farther down the creek and on the beach by a considerable thickness of lava-streams and non-brecciated rock. Compare with specimen No. 696, which is from the same place.

No. 330/713.

M.C. — Pale-green decomposed rock, with obscure felspar phenocrysts, speckled darker green.

U.M.—MATRIX: Abundant, more than half the rock; consists of minute felspar in flow-lines, green chlorite, jagged quartz grains, and minute bipyramids, leucoxene.

PHENOCRYSTS.—*Plagioclase:* Fairly numerous not large crystals, chiefly rectangular sections, lamellar horns; ext., 24° / 26°, 30° / 33° (andesine–labradorite). More or less decomposed, containing carbonates, chlorite, and epidote.

Pyroxene represented by fairly numerous rather small pseudomorphs in green chlorite (pennine), with sometimes epidote and associated leucoxene. Some of the pyroxene was probably hypersthene.

Titaniferous magnetite converted into white leucoxene.

No hornblende nor quartz grains.

Altered Pyroxene Andesite.

Locality.—Right bank of Tararu Creek, opposite the siphon below Tinker's Creek junction, Thames Goldfield.

Formation.—Thames-Tokatea group.

Remarks.—This rock has the appearance of the matrix of the breccias at the siphon on the left bank of the creek. It forms a massive development between the siphon breccias and the rocks at the junction of Tinker's Creek, which latter are also breccias of medium grain.

No. 331/719.

M.C.—Greenish-grey compact rock, spotted and speckled darker green.

U.M. — MATRIX formed by abundant felspar laths and rectangles in stream-lines, chlorite pseudomorphs, jagged quartz grains, scattered leucoxene, and carbonates. Matrix about half the rock.

PHENOCRYSTS.—*Plagioclase* represented by fairly numerous small crystals, clusters, and fragments, fairly fresh, but contain carbonates, chlorite, and epidote in small quantity; ext., 24°/25°, 36°/37° (andesine–labradorite).

Pyroxene represented by numerous pseudomorphs in green chlorite (pennine), with associated leucoxene and carbonates, some nearly all carbonates. Outlines suggest hypersthene as well as augite. Some pseudomorphs in remarkable quartz mosaics, seem to be after pyroxene.

Ilmenite represented by leucoxene, fairly abundant. Some irregular cavities filled with chlorite and some quartz.

Altered Pyroxene Andesite.

Locality.—Tararu Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This rock somewhat resembles specimens from the North Star Claim on the south-east higher slope of Una Hill in the southern part of the district.

No. 332/721.

M.C.—Bluish-grey compact rock, with small phenocrysts of felspar and ferro-magnesian minerals.

U.M.—MATRIX coarse-grained, phanero-crystalline, consisting of plagioclase rectangles, quartz grains, chlorite pseudomorphs, hornblende, epidote, magnetite grains, and leucoxene.

PHENOCRYSTS.—*Plagioclase* abundant. Chief constituent crystals much broken in places by numerous irregular more or less parallel fractures into which quartz has been introduced and in which epidote occurs, otherwise the felspar is fresh or not much altered. Much is zonal, and negative crystals with indeterminate contents are richly present in a submarginal band; ext., 23°/23°, 30°/30°, 30°/42° (andesine–labradorite).

Augite: Numerous crystals, fresh, faint yellowish-brown, almost colourless, twinned in cases, some while otherwise fresh partly replaced by quartz, some passing into fibrous hornblende, which in turn passes into chlorite.

Hypersthene represented by pseudomorphs in chlorite; occurs in some cases associated with augite in clusters.

Hornblende: Fragments and crystals, faint-green / faint straw-yellow, numerous; well-marked resorption borders.

Magnetite in irregular grains, numerous, usually without leucoxene border, but a good deal of leucoxene is present. The internal brecciation of the rock is a marked character; quartz seems to have been introduced, as well as derived from the chlorisation of pyroxene. The alteration of the minerals seems most capricious, but is connected with brecciation.

Hornblende Hypersthene Andesite.

Locality.—Upper part of Tararu Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This is the highest rock in the apparent sequence of the volcanic rocks of Tararu Creek and the Thames Goldfield. Other yet higher rocks are found towards the sources of the creek and the mountain-ridge (2,000 ft.) that makes the water-divide between Tararu Creek and the Kauaeranga or the Waiwawa. These, however, may possibly be in part rocks of the Beeson's Island group, which have a great development further to the westward.

No. 333/724.

M.C.—Green decomposed rock, with felspar and ferro-magnesian phenocrysts, and white patches.

U.M.—Matrix forms considerably more than half the rock, and is very fine-grained. Felspar laths no longer visible. Minute grains of quartz, some of them bi-pyramids; chlorite scales and (?)kaolin, with clusters of leucoxene granules, are present.

Phenocrysts.—*Plagioclase* as well-formed crystals, but neither numerous nor large, and almost entirely replaced by carbonates. When felspar residual is present it shows lamellar twinning. Some of the crystals evidently contained broad submarginal inclusions of the groundmass.

Pyroxene: Well-formed crystals as pseudomorphs, almost as numerous as the felspar crystals; consist now of green chlorite (pennine) or of chlorite and carbonates; they contain some colourless apatite, but frequently are free from iron-ores. In many cases a second hydrated decomposition product of higher double refraction, and colourless, forms a margin to the chlorite, and fills cracks traversing it.

Hypersthene was undoubtedly present as well as augite; the pseudomorphs after hypersthene consist of very clear pennine.

Hornblende: Well-formed crystals represented by pseudomorphs in chlorite and carbonates, fairly numerous, without reaction borders.

Quartz: A few corroded grains.

Ilmenite represented by leucoxene nets.

Altered Hypersthene Hornblende Dacite, or Quartz Hornblende Hypersthene Andesite.

Locality.—Road-cutting 4 chains above junction of Tinker's Creek, Tararu Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.— This specimen at the time of collection was considered a much-decomposed rock, but much effort failed to produce a better sample. Although the resemblance is not close, the specimen may be compared with No. 696, which is from a breccia conglomerate that underlies.

No. 334/732.

M.C. — Pale-green decomposed rock, with large dark-green pseudomorphs after some ferro-magnesian mineral and smaller white felspar phenocrysts.

U.M. — Matrix about half the rock; it consists chiefly of radiating long slender felspar rectangles converted into quartz mosaics, which usually consist of a single series of quartz grains, and interstitial chlorite. In places, however, this structure is exchanged for that of the more usual character in andesites, felspar laths (now altered) running in stream-lines, with quartz grains and chlorite. Leucoxene granules are generally dispersed.

PHENOCRYSTS.—*Plagioclase:* Fairly numerous not large crystals; contain much epidote, both colourless and yellow; broad twinning bands; ext., 5°/ 7°.

Orthoclase: A good deal; perhaps most of the felspar is without lamellar twinning; ext., about 7° with edge 010, 001 on 010, and at 23° with edge 110, 010, the *r.i.* being below that of balsam.

If these characters may be trusted in a rock so altered as the present, much of the felspar should be orthoclase.

Next to epidote, carbonates are the commonest replacement products in both felspars; some chlorite is also present. Some of the crystals have an internally brecciated structure, and quartz seems to have been introduced into them.

Pyroxene represented by pseudomorphs in green chlorite (pennine) and another replacement product which I cannot identify; it is colourless, of higher *r.i.* and higher double refraction than chlorite. The pyroxene was not abundant, and the crystals were mostly small. Carbonates and leucoxene occur in some of the pseudomorphs, and quartz; apatite also is included.

Ilmenite passing into leucoxene, fairly common.

Altered Pyroxene Andesite, or **Pyroxene Rhyolite,** containing orthoclase, with radiate felspar laths in matrix.

Locality.—Lower shaft, Adelaide Claim, west slope of Una Hill, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This rock is closely associated with green- and purple-coloured fragmental rocks in the north-west part of the claim, and in Karaka Creek opposite the junction of Collarbone Creek.

No. 335/733.

M.C.—Green rock, with greenish-white felspar, reddish patches, and darker-green spots.

U.M.—The rock is much decomposed and consequently difficult to make out, but there appears to be at least two different kinds of andesite present. The commonest, making up the most of the rock, has the following characters:—

(1.) MATRIX.—Abundant, consisting of decomposed felspar laths crowded in stream-lines, abundant chlorite, dispersed leucoxene granules, some quartz and carbonates.

PHENOCRYSTS.—*Felspar* transformed beyond determination, represented by pseudomorphs in kaolin and carbonates, which are not numerous nor large.

U.M.—Matrix: Abundant, very fine-grained, forms at least half the rock, small irregular quartz grains and chlorite scales constitute the greater part, leucoxene granules disseminated. Felspar laths in stream-lines appear to have been present originally.

Phenocrysts.—*Plagioclase:* Numerous large crystals beginning to show signs of alteration, carbonates and mica appearing, and inclusions converted into chlorite. Twinning survives in most, but in many is growing faint. Some *orthoclase* may be present.

Pyroxene: Not very much, represented by pseudomorphs in green chlorite, containing some leucoxene.

Hornblende abundantly represented by well-formed usually small but sometimes large pseudomorphs.

Quartz: Numerous corroded grains.

Ilmenite represented by leucoxene.

Pyrites: A considerable quantity dispersed throughout the slice in cubes.

Hornblende Dacite, with pyroxene.

Locality.—Adelaide Claim, upper shaft, west face of Una Hill, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This rock overlies the red and green breccias of the lower tunnel and the western part of the claim.

No. 338/745.

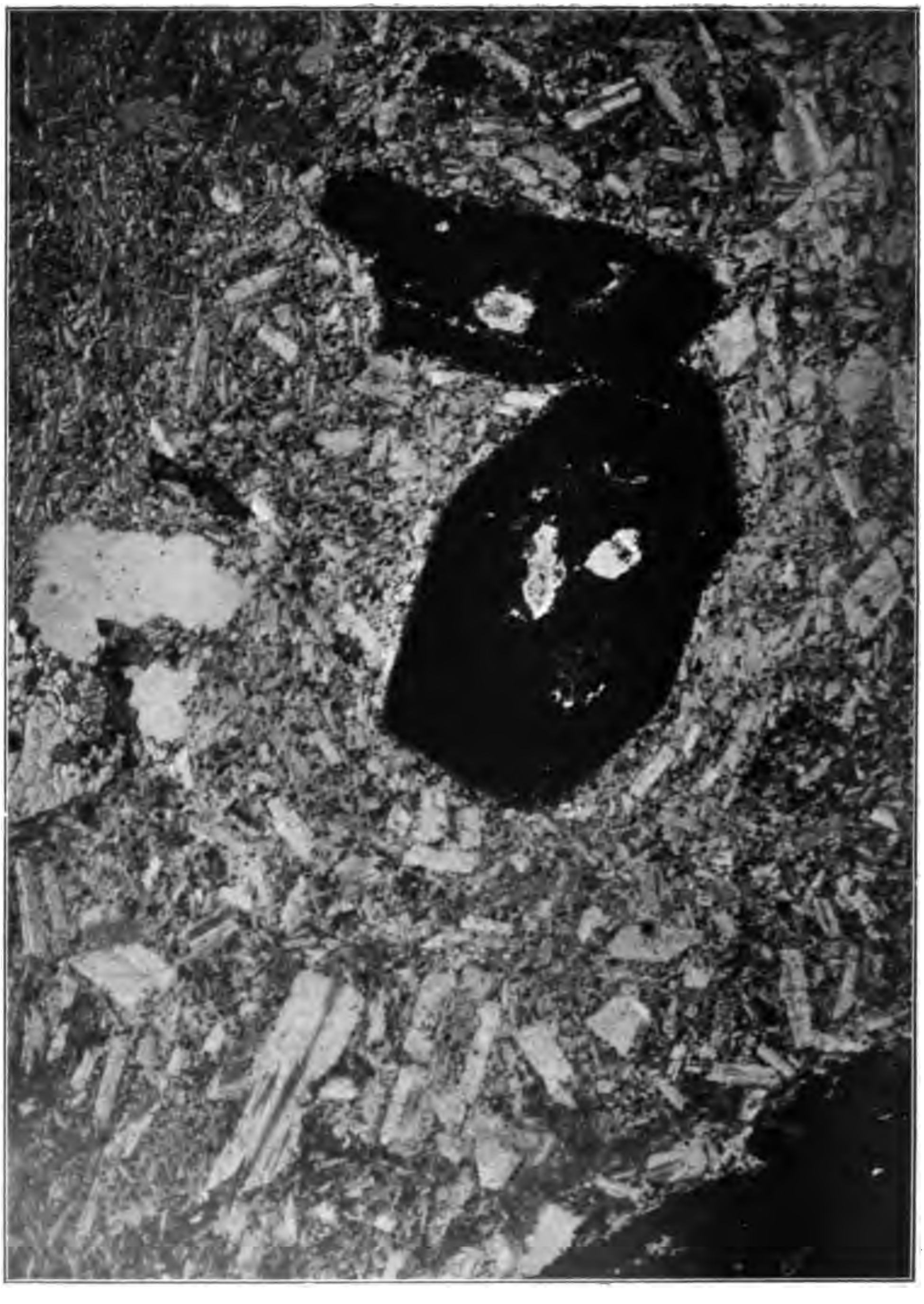
M.C.—Greyish and purplish rock, lustreless, containing phenocrysts.

U.M.—Matrix: A mosaic of micropœcillitic quartz in comparatively large grains. The enclosed mineral is incompletely transformed felspar in small rectangles which stain with fuchsine. Felspar in crystals of the size of the micropœcillitic quartz grains is richly scattered through the slice; it also is much altered. Disseminated leucoxene after magnetite.

Phenocrysts.—*Felspar* converted into white mica, sometimes with a narrower or broader colourless isotropic marginal zone which stains uniformly with fuchsine, abundant in large and medium-sized crystals.

Pyroxene in large crystals converted into carbonates which do not readily dissolve, colourless serpentine, and other material not easily determinable, perhaps iron-hydrate. Pyrites is sometimes included, and leucoxene.

Leucoxene after ilmenite, and pyrites dispersed. The matrix contains leucoxene in granular rods arranged in flow-lines, suggestive of a vanished mineral which had a prismatic form.



No. 339/748. HORNBLENDE HYPERSTHENE ANDESITE.

[*To face p. 99, Vol. II.*

This rock is far too much altered to be determinable. The matrix is like that of many andesites, but the felspar is too much altered to furnish decisive evidence of its original composition. The predominance of white mica as the replacement mineral suggests orthoclase.

Indeterminate.

Locality.—Upper shaft, Adelaide Claim, Una Hill, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This may be a fine-grained and indurated breccia, such rocks being met with at higher levels on the west slope of Una Hill.

No. 339/748.

M.C.—Black basalt-like rock, with small phenocrysts.

U.M.—MATRIX: Very little, and showing insensible passage from smallest constituents to largest. The most minutely crystalline material consists of felspar (plagioclase) laths and rectangles, minute prisms of pyroxene, and octahedra of magnetite, with interstitial chlorite that may possibly represent altered glass. The minute pyroxene prisms, not so large as many of the magnetite grains, are perfectly fresh.

PHENOCRYSTS.—*Plagioclase:* Abundant but not large crystals, sometimes in radiate grouping; zonal; twinning wedgy; ext., 20°/23°, 25°/27° (andesine, andesine–labradorite). The plagioclase is fresh, but alteration is commencing; carbonates are present in many, and some of the inclusions are converted into chlorite.

Augite: Fresh, colourless or nearly so, commonly in mosaics, twinned once or twice.

Hypersthene abundant, in all stages of serpentinisation, contributes to the mosaic of augite grains, and sometimes includes augite.

Hornblende: Resorption pseudomorphs of large size fairly numerous; reaction borders curiously zonal.

Carbonates sporadically present, also an irregular band, as if filling an elongated vesicle; where the pyroxene projects into this it is converted into quartz mosaic, a core of chlorite occupying the interior.

Hornblende Hypersthene Andesite.

Illustration.—Slice shows good contrasts between the minute and larger constituents of the matrix and the much larger phenocrysts that float therein.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper left, which is fairly characteristic of the other parts of the slice.

There is a tendency of the constituents of the matrix to conform to the direction of the longer axis of the larger phenocrysts, which, though plainly discernible in the reproduction, is not equal to what appears in the original print.

Locality. — North Star Claim, south-east higher part of Una Hill, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This is a fine-grained rock, and the large dark phenocryst, as rendered by polarised light, is exceptional. The rock may be fragmental, most of the material on the tip-head whence the specimen was taken showing clearly as coarse or finer-grained breccias.

No. 340/749.

M.C. — Black basalt-like rock, or dolerite-like, obvious but not large phenocrysts.

U.M.—MATRIX in places and on the whole generally micropœcillitic, with minute felspar laths in strong relief in the portions which are not so, and almost vanishing in the micropœcillitic areas; the felspar laths and rectangles crowded in stream-lines; minute pyroxene grains and prisms, and other pseudomorphs sparingly scattered. Abundant granules and octahedra of magnetite. Matrix about half the rock.

PHENOCRYSTS.—*Plagioclase:* Numerous generally more or less rectangular sections, fresh, with central or submarginal inclusions of negative crystals; ext., 26°/29° (andesine).

Augite: A fair number of large crystals and fragments, faint-greenish tint; includes magnetite, beginning to undergo alteration.

Hypersthene also fairly common, fresh, with the usual pleochroism well marked; includes magnetite.

Hornblende: One solitary xenocryst surrounded by an aureole of plagioclase, quartz, and pyroxene. Iron-ores fairly abundant.

Hypersthene Andesite.

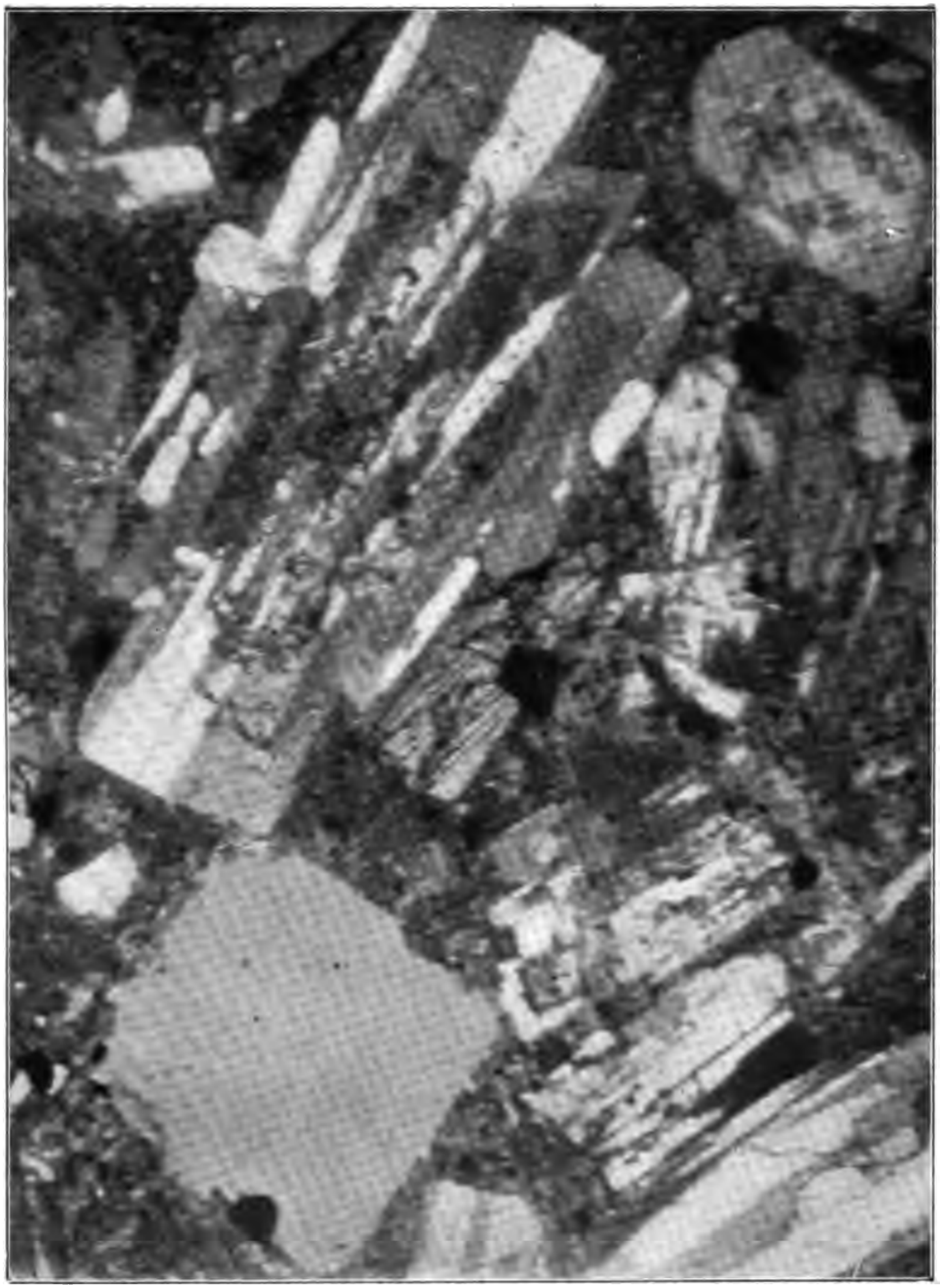
Illustration.—Slice shows good contrasts of the different parts, and in the part selected fair contrasts.

Photographed by polarised light; magnification, 112 diameters; area photographed, middle part, which, owing to the very considerable magnification, cannot be considered characteristic of the whole slice.

Locality.—Peak east of Una Hill on the range between Karaka Creek and the upper part of Hape Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This rock forms part of a lava-stream declining towards the east, and in the lower grounds probably represented by outcrops of rock, from which specimens were collected, and in two cases have been referred to as probably from the same lava-floe as that from which the specimen above described was taken.



No. 340/749. HYPERSTHENE ANDESITE.

[*To face p. 100, Vol. II.*

No. 341/754.

M.C.—Spherulitic rhyolite.

U.M.—MATRIX for the most part spherulitic, brown by transmitted and milky-white by reflected light; it has evidently suffered alteration; the usually dark trichite rays of the spherulites are also white and opaque. Minute felspar laths are sparingly strewn through the spherulites. The spherulites frequently become clearer and crystalline towards the margin, and often present a polygonal outline owing to interference by growth.

PHENOCRYSTS.—*Quartz* in characteristic corroded grains and bi-pyramids, fairly common.

Biotite in large well-formed crystals, brownish-yellow / deep-green (black).

Spherulitic Rhyolite.

Locality.—Track to the Wires from Hikutaia Valley, Hikutaia district.

Formation.—Acid group of Pliocene age.

Remarks.—The rock where the specimen was collected occurs in the near vicinity of the underlying andesites belonging to the Beeson's Island group, and possibly any alteration which the specimen has undergone may be sufficiently explained by the fact stated.

No. 342/759.

M.C.—Cream-white vesicular and spherulitic rhyolite.

U.M.—Consists chiefly of spherulites with positive sign; some quite circular in section; some with regular spherical growth form a mosaic by interference with their neighbours; some ellipsoidal or elongated owing to having originated about an elongated nucleus, such as a crystal of biotite; others elongated along flow-lines; a very few with pseudopodial processes. Brown by transmitted and milky-white by reflected light, distinct double refraction. Many are hollow or filled with glass, which is colourless, but divided by a reticulum of bluish threads into rounded polygonal areas, somewhat recalling the appearance of tridymite. That this material is truly glass is shown by its isotropic character, and the fact that it undergoes no appreciable change by boiling in strong caustic-soda solution or in hydrochloric acid. It does not stain with fuchsine. The hollow spherulites and those containing glass are chiefly those elongated forms that follow the flow-lines; they are usually more or less decomposed within, the brown granular character being chiefly displayed in the outer peripheral part.

It not unfrequently happens that hollow spaces remain between the well-formed spherulites; these, having afforded room for growth, are frequently partly occupied by a coarser growth of the surrounding spherulites and partly by the colourless glass already mentioned. The constituents of the spherulites being thus more obviously differentiated, it becomes possible to determine with some certainty their mineral character; there are only two constant constituents, and these are felspar and glass. The felspar is in elongated prisms, and has a *r.i.* not very different from that of balsam, but in most cases somewhat below.

The glass can be easily traced between the felspar prisms, and is crowded transversely by the blue lines already mentioned. Trichites, as usual, occur in the brown part of the spherulites, usually running radially, some transversely.

Scattered through the slice, and occasionally forming the nucleus of a brown spherulite, are spherulitic growths of another kind; they are water-clear and colourless, and, though frequently presenting rounded outlines, are as often bounded by a crystalline figure; they are intergrowths of quartz and felspar, to which the felspar has given its form. Such intergrowths are well known in rhyolites from various parts of the world, and I have seen them in rhyolites from Tardree, Ireland.

Certain streaks remain between the spherulites, in which a confusedly crystalline structure occurs.

PHENOCRYSTS.—*Orthoclase:* Well-formed crystals, not numerous, quite fresh.

Plagioclase: A few crystals with low angle of extinction; *r.i.*, = or below balsam.

Biotite: A few crystals straw-yellow / deep-green.

Quartz in corroded grains and bi-pyramids, with large negative crystal, in one case containing colourless glass and a large bubble.

Zircons: An occasional crystal.

Spherulitic Rhyolite, containing orthoclase and plagioclase.

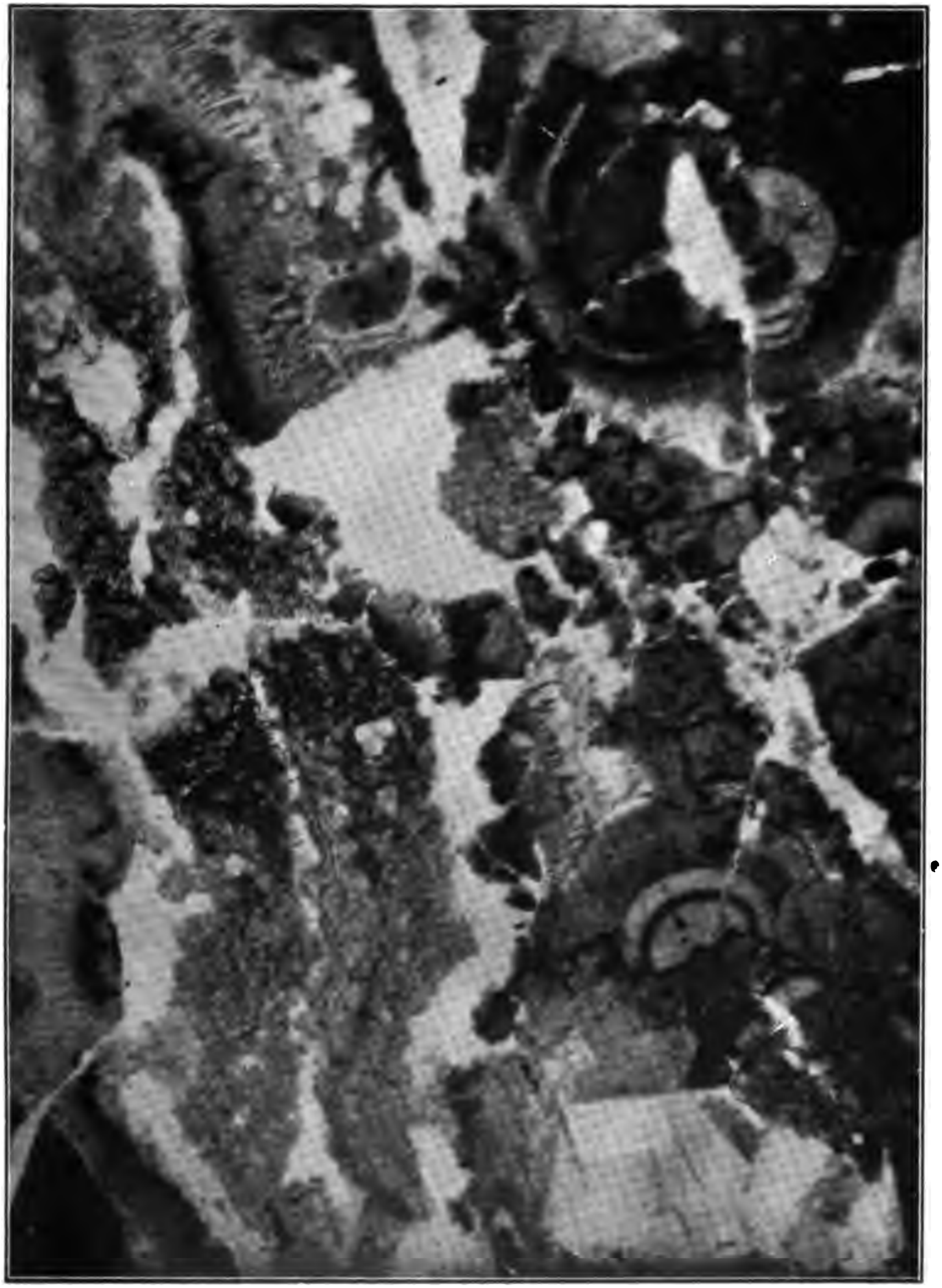
Illustration.—Slice in the part selected shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower middle part, which is characteristic of the lower half of the slice, the upper part being somewhat different.

Locality.—Track from Hikutaia Valley to the Wires, at 900ft. above the riverbed, Hikutaia district.

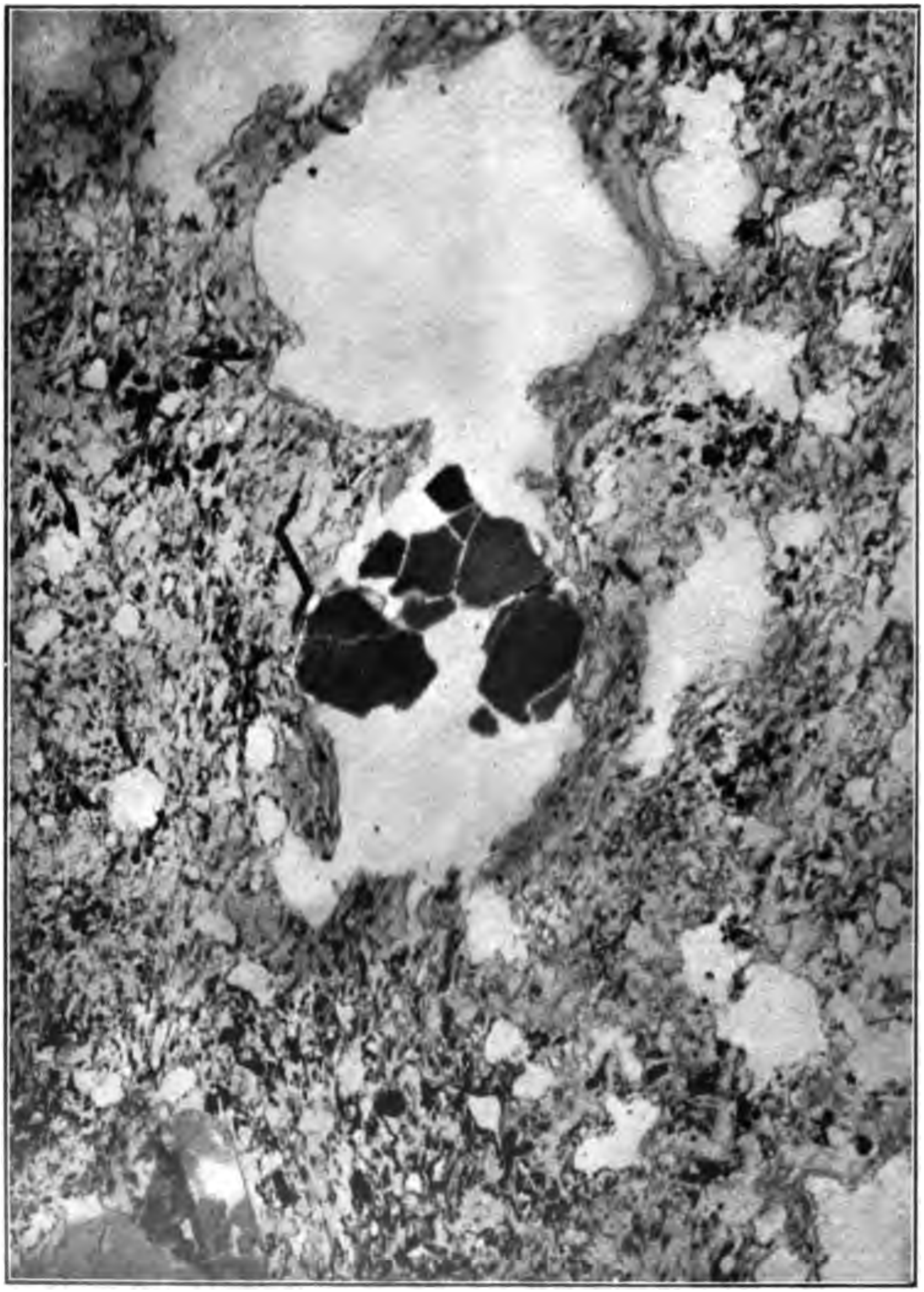
Formation.—Acid group of Pliocene age.

Remarks.—From the first outlying patch of rhyolite, after leaving the Hikutaia River bed, on the road to the Wires. Further to the east and at higher levels there is a great development of pumiceous agglomerate, the relation of which to the rock being described cannot be definitely stated. Equally the agglomerate and this rock rest on andesites of the Beeson's Island group, and it cannot therefore be said from this evidence alone that the solid rhyolite is the oldest rock.



No. 342/759. SPHERULITIC RHYOLITE.

[To face p. 102, Vol. II.



No. 343/761. PUMICEOUS RHYOLITE.

[To face p. 103, Vol. II.

No. 343/761.

M.C.—Light-grey pumiceous rhyolite.

U.M.—Colourless glass, with elongated vesicles such as characterize pumice.

PHENOCRYSTS.—*Orthoclase :* Fairly numerous crystals and fragments.

Plagioclase : A very few crystals, low extinction angles; *r.i.*, almost equal to that of balsam, slightly above.

Biotite : Well-formed crystals, sometimes corroded, yellowish-brown / dark-green, not numerous.

Quartz : Not numerous, large grains. Occasionally a cluster of large crystals including orthoclase, plagioclase, biotite, and quartz in association.

Pumiceous Rhyolite.

Illustration.—Slice shows moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper left, which is fairly characteristic of the rest of the slice.

Locality.—The Wires, near the Big Dam, Upper Tairua Valley, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—From a coarse breccia underlying fine-grained stratified beds that are well displayed in the banks of the main source of the Tairua River. This breccia or agglomerate in all probability rests on the pumiceous agglomerate which more to the west forms the bold scarp overlooking the Hikutaia.

No. 344/763.

M.C.—Pumiceous ash.

U.M.—MATRIX isotropic, with minute polarising granules, shreds of clear glass, and fragments of felspar scattered through it.

PHENOCRYSTS : *Quartz* in broken grains.

Plagioclase in splinters, crystals, and complex growths, sometimes zonal, and sometimes with zonal inclusions of glass; *r.i.*, above balsam; ext., various from 10° to 30° (andesine–labradorite).

Augite : Nearly colourless, in small well-formed crystals, rare.

Hornblende is commoner than augite, olive-green / olive-yellow.

Biotite in crystals with rounded corners, straw-yellow / greenish-brown, not common.

Magnetite : A few grains.

Fragments of pumice plentifully scattered.

Tuff.

Locality.—The higher part of the steep scarp on the new road from the Hikutaia Valley to the Wires, in the Upper Tairua, Hikutaia district.

Formation.—Acid group of Pliocene age.

Remarks.—The specimen, which is a light-grey fine-grained pumiceous breccia, was collected principally on account of a remarkable inclusion of black perlitic glass, of which no mention is made in the description of the specimen. The rock is equal to what has been called "pumiceous agglomerate" from the Gumtown and Mercury Bay districts, and the bulk of the deposit in the Hikutaia watershed is identical with the pumiceous agglomerate in the localities mentioned.

No. 345/794.

M.C.—Greyish-white, light, porous, very fine-grained rock.

U.M.—The two chief constituents of the rock are arranged in alternating very narrow line-like bands, running parallel in stream-lines. One of the constituents is a greenish, granular, almost isotropic material, which sometimes forms a linear series of bead-like forms, and which is probably a hydrated glass; the other is a nearly colourless, minutely fibrous substance, which is weakly doubly refracting. Transverse cracks of short extent cross these streaks, and are filled with the greenish material, bordered by the finely fibrous. The greenish granular material stains deeply with fuchsine, the fibrous only very faintly, and this fortunately enables the relations of the two to be clearly distinguished. It is thus seen that the greenish substance forms the centre of the stream-bands, and the fibrous grows from it on each side; the opposite fibrous layers of two adjacent streaks extend towards each other without coming in contact, a thin median line of colourless isotropic substance separating them. The thickness of the fibrous layer on one side of a green streak may be much greater than the other. The fibrous layer also bounds the green lines which occupy the transverse cracks. In places these structures are replaced by patches of colourless glass. The fibrous layer thickens out in places over lenticular areas, within which it may occur in minute spherulitic forms.

Remarkable growths of quartz are also present. The crystals of this mineral have developed (without acquiring crystal outlines) mostly along the flow-lines, though also across; they may replace a single streak of the green fibrous substance over short interrupted lengths, or they may replace several and include some, and then present a micropœcillitic appearance. The quartz forms simple crystals, not mosaics.

The rock was evidently a flow, and not a tuff.

Rhyolite, with flow-structure.

Locality.—Kauaeranga River, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—This has been derived from the main range south of Table Mountain. A considerable proportion of the gravels of the Kauaeranga River bed is formed of rhyolitic material, and as all of this is of necessity derived from the main range, in which the river takes its rise, or from the pumiceous tuffs that form the saddle between the source of the Waiwawa and Waiwawa Creek, west of Table Mountain, there can be but little difficulty in referring the rocks to their correct source.

No. 346/795.

M.C.—Breccia of rhyolite.

U.M.—Irregular fragments of rhyolite, the space between them filled with smaller fragments of rhyolite, fragments of felspar, micropœcillitic quartz, and indeterminable dust; a rhombohedron of carbonate, and abundant altered colourless material, which stains deeply with fuchsin.

The rhyolite consists of spherulitic material, sometimes arranged in parallel threads running with the stream-lines, which are also marked by trichites, and sometimes in spherulites, with positive sign, and of very different sizes; in some fragments large, in others very minute. The large may contain excentric cavities filled with (?)tridymite, and sometimes present a few biotite crystals divided radially from the centre. Globulitic structures occur, and coarser crystalline aggregates, in which lie pools filled with (?)tridymite. To determine whether this mineral was truly tridymite a slice was digested in strong caustic-soda solution. After seven hours' treatment at 100° C. it was found to have undergone scarcely any change. The whole question of the identification must be investigated. I doubt the statement of authors that it is readily soluble in sodium-carbonate solution. If this mineral is not tridymite it must be some new and undescribed species.

Rhyolite.

Locality.—The Kauaeranga River bed, Kauaeranga district.
Formation.—Acid group of Pliocene age.
Remarks.—Derived from the mountains of the main range, and thence carried along the Kauaeranga to near the mouth of the river. Most of the acid rocks described as coming from the Kauaeranga district were collected from the river-bed, but as it is only in the mountains from which the river rises that acid rocks occur within this watershed the source of the specimens is thus determined.

No. 347/797.

M.C.—Yellowish-white friable rock, crowded with pseudomorphs after felspar.

U.M.—Matrix constitutes about half the rock, completely kaolinised; contains, in addition to kaolin, minute granules of quartz.

Phenocrysts.—Felspar completely kaolinised.

Pyroxene: It is impossible to assert its presence or absence.

Hornblende: Several large pseudomorphs in chlorite and mica, with included pseudomorphs after felspar or pyroxene, and magnetite grains in some cases.

Magnetite: Some large grains, not very titaniferous.

No corroded quartz grains.

This may have been a **Hornblende Andesite.**

Locality.—The Booms, Lower Kauaeranga Valley, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This rock forms a belt of some considerable thickness, and is well exposed in the road-cuttings on the north bank of the river. The rock readily decomposes, and in this state appears to be formed of light-grey crystals, which cohere as a somewhat soft rock, or separate into individual crystals, which may be collected at the base of the low cliff-exposures on the roadside.

No. 348/799.

M.C.—Greyish-green rock, speckled white with felspar phenocrysts.

U.M.—Matrix: Long divergent rays of plagioclase with interstitial chlorite, the plagioclase laths replaced more or less by quartz. Magnetite and leucoxene grains dispersed.

Phenocrysts.—*Plagioclase:* Numerous not large crystals, largely converted into epidote and carbonates, with chlorite derived from inclusions.

Pyroxene: Neither very numerous nor large, converted into green chlorite (pennine) and carbonates.

Magnetite and *ilmenite* passing into leucoxene, numerous.

Altered Pyroxene Andesite.

Locality.—Upper part of the valley of Shellback Creek, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—This rock forms hard bands in the range between the upper part of Shellback Creek and Tinker's Gully, but has not been distinctly recognised in the valley of Tararu Creek, which it should cross somewhere in the vicinity of the siphon a little below where Tinker's makes junction with the main stream.

No. 349/802.

M.C.—Black dolerite-like rock.

U.M.—MATRIX about half the rock, micropœcillitic, crowded with minute felspar laths; chlorite after pyroxene scarce; abundant minute octahedra of magnetite generally dispersed.

PHENOCRYSTS.—*Plagioclase:* Abundant, fairly large, generally rectangular sections in stream-lines; ext., 32°/35° (labradorite); zonal; inclusions central and submarginal, negative crystals of matrix now forming felspar, decomposition products from pyroxene.

Augite: Fairly numerous crystals, often broken, patches rich in small crystals are present; almost colourless; ext., 40°; fairly fresh, beginning to pass into serpentine.

Hypersthene: Numerous crystals in all stages of transformation into green serpentine, and finally carbonates.

Magnetite: A fair quantity; no leucoxene margin.

A little *biotite,* almost colourless, faint salmon-red / yellow-brown, occurs with quartz in association with the decomposition products of hypersthene in some cases.

Black Micropœcillitic Hypersthene Andesite.

Locality.—Ridge north of Punga Flat, between the source of Shellback Creek and Tinker's Gully, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—The rock extends along the higher part of the range for some distance from the locality of the specimen, but does not seem to reach into the valley of Tararu Creek.

No. 350/813.

M.C.—Light greenish-grey lustreless rock, speckled with white felspar phenocrysts.

U.M.—MATRIX: Laths and rectangles of felspar generally muscovitised, chlorite, jagged grains of quartz, and scattered leucoxene.

PHENOCRYSTS.—*Plagioclase* abundant, mostly converted into carbonates, mica, and kaolin.

Pyroxene represented by pseudomorphs, which in many cases have lost their original outlines, and consist of a green fibrous and granular chlorite-like mineral, which is isotropic, and contains grains of quartz and pyrites.

Hornblende: A few pseudomorphs with a network of leucoxene may represent hornblende.

Iron-ores represented by leucoxene. Pyrites in a good many dispersed crystals.

Altered Pyroxene Andesite, with hornblende(?).

Locality.—Upper part of Shellback Creek, Thames district.
Formation.—Thames-Tokatea group.
Remarks.—This rock extends north into the valley of Tararu Creek and southward across the productive part of the Thames area of the goldfield.

No. 351/818.

M.C.—Light greyish-green rock, with phenocrysts of felspar and ferromagnesian minerals.

U.M.—MATRIX abundant, at least half the rock, crowded with minute felspar laths and larger rectangles more or less in stream-lines; chlorite scales, patches of carbonates generally distributed, some quartz, leucoxene abundantly dispersed, and some magnetite.

PHENOCRYSTS.—*Plagioclase:* Abundant well-formed crystals, beginning to suffer alteration, mica and carbonates appearing in small quantity. When freshest ext. 34° / 34° (labradorite). Sometimes a little epidote and quartz are present, as well as chlorite. Some fairly free from inclusions; others with zonal inclusions.

Pyroxene represented by fairly numerous pseudomorphs in green chlorite (delessite) and carbonates, with associated magnetite containing little titanic acid. The delessite is in parallel or nearly parallel fibres (froissées), not in spherulites or rosettes; its *r.i.* is about 1·619; ext., 0°, and optical sign + in relation to length of fibres; its pleochroism is ferrous-green / light-yellow, and it polarises in yellowish-green colours.

Magnetite and *apatite,* with axial black striæ, are present.

Altered Pyroxene Andesite.

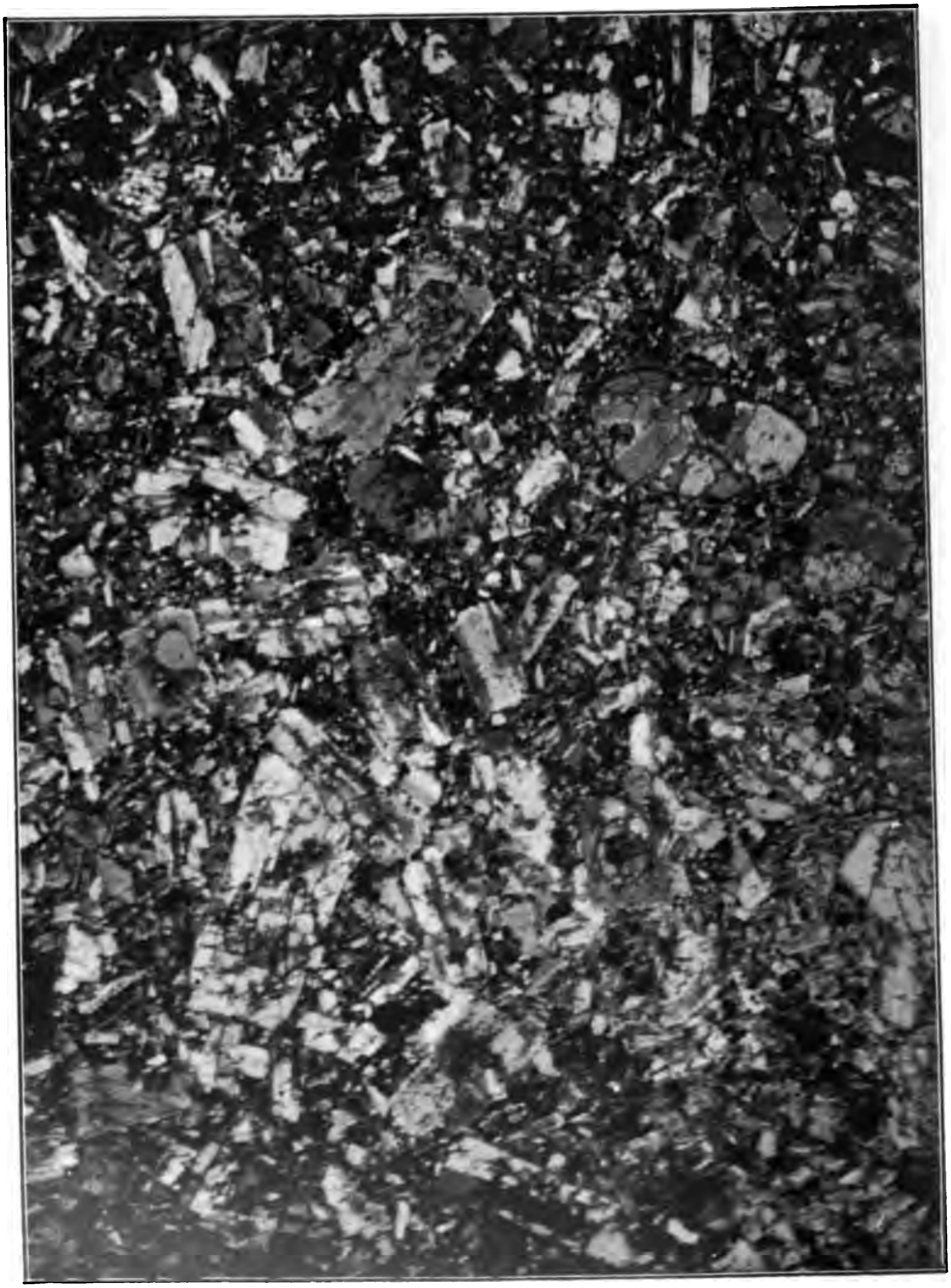
Locality.—Right bank of Tararu Creek at and below the siphon on water-race crossing below Tinker's Gully, Thames district.
Formation.—Thames-Tokatea group.
Remarks.—This and a lighter-green rock has a large development from opposite the siphon down the valley of Tararu Creek.

No. 352/822.

M.C.—Dark-grey lustrous rock, with small felspar phenocrysts.

U.M.—MATRIX coarse-grained, holocrystalline, with interstitial quartz and micropœcillitic texture; plagioclase in rectangles; some chlorite pseudomorphs after pyroxene, showing here and there carbonates; magnetite grains and leucoxene, also pyrites.

PHENOCRYSTS.—*Plagioclase* abundant, chiefly in rectangular sections, with the long axis lying mostly in the same direction as though in stream-lines;



No. 353/823. HYPERSTHENE ANDESITE.

[*To face p. 109, Vol. II.*

ext., 23° / 26°, 29° / 36° (andesine–labradorite); mostly fresh, but beginning to develop mica; some crystals considerably altered, mica occupying a large part of the interior; sharply demarcated zonally.

Pyroxene: Fairly numerous pseudomorphs in green chlorite (pennine) and carbonates; no fresh pyroxene, completely transformed.

Magnetite abundant, not containing much TiO_2. Apatite as inclusions in plagioclase.

Altered Pyroxene Labradorite Holocrystalline Rock, a phanerocrystalline representative of pyroxene andesite, or **Quartz Diabase.**

Locality.—Moanataiari Tunnel, Thames district.

Formation.—Thames-Tokatea group.

Remarks.—The specimen was taken from the face of the tunnel 3,000 ft. from the entrance, where the excavation is several hundred feet from the surface overhead. This seems to be a somewhat peculiar rock, the like of which does not occur on the Thames Goldfield, nor elsewhere on Cape Colville Peninsula.

No. 353/823.

M.C.—Dark-grey compact rock, with phenocrysts of felspar and augite.

U.M.—MATRIX rather coarse-grained. Contains plagioclase laths and rectangles, interstitial and micropœcillitic quartz, pseudomorphs after interstitial pyroxene, abundant magnetite grains, and some leucoxene. Matrix about one-quarter of the rock. Laths, &c., make a gradual passage up to phenocrysts.

PHENOCRYSTS.—*Plagioclase:* Abundant, chiefly rectangular sections, with a tendency to radiate grouping; ext., 29°/ 30°; zonal; often a marked difference in the extinction angle between centre and exterior. Fairly fresh, beginning to undergo alteration. Chlorite rather common in interior of felspar.

Augite: Fresh, in very remarkable mosaics, forming a complex of rounded or irregular form, faint-brownish colour; some of the grains synthetically twinned. Altered into green fibrous hornblende in centre of one mosaic.

Hypersthene represented by pseudomorphs of large crystals in green chlorite (pennine and clinochlore); includes magnetite and leucoxene.

Magnetite: Somewhat numerous grains; a little leucoxene.

Hypersthene Andesite of an unusual kind.

Illustration.—Slice is fine-grained; no large phenocrysts in the part photographed.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle right, which gives a fair idea of the other parts.

Locality.—Upper part of Tararu Creek, Thames County.
Formation.—Thames-Tokatea group.
Remarks.—The specimen comes from some distance down the creek from where specimen No. 721 was taken.

No. 354/833.

M.C.—Dark-grey compact rock, with phenocrysts of felspar.

U.M.—MATRIX loaded with carbonates. When these are removed by acid the matrix is found to be micropœcillitic, with felspar rectangles and traces of vanished microliths; chlorite scales and mica are scattered through the slice, and leucoxene granules after magnetite. Many of these granules are homogeneous and transparent, and retain the form of magnetite. Matrix somewhat less than half the rock.

PHENOCRYSTS.—*Plagioclase:* Abundant, chiefly rectangular, fairly fresh, with micacised cores and zones in many instances; some carbonates also may be present, but not much; ext., 25°/28° (andesine–labradorite).

Pyroxene: Not very numerous pseudomorphs, in green chlorite (pennine) and clinochlores and carbonates; large grains of leucoxene associated.

Hornblende: One small resorption pseudomorph.

Ilmenite: Plates passing into leucoxene fairly numerous.

Pyrites sparingly present.

Pyroxene Andesite (micropœcillitic).

Illustration.—Slice shows fair contrasts.
Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which is fairly characteristic of the whole slice.
Locality.—Kuranui-Caledonian Mine, Thames district.
Formation.—Thames-Tokatea group.
Remarks.—The specimen is from the No. 4 level of the mine, and near to where, owing to decomposition of the rocks, the temperature is much higher than elsewhere in this mine.

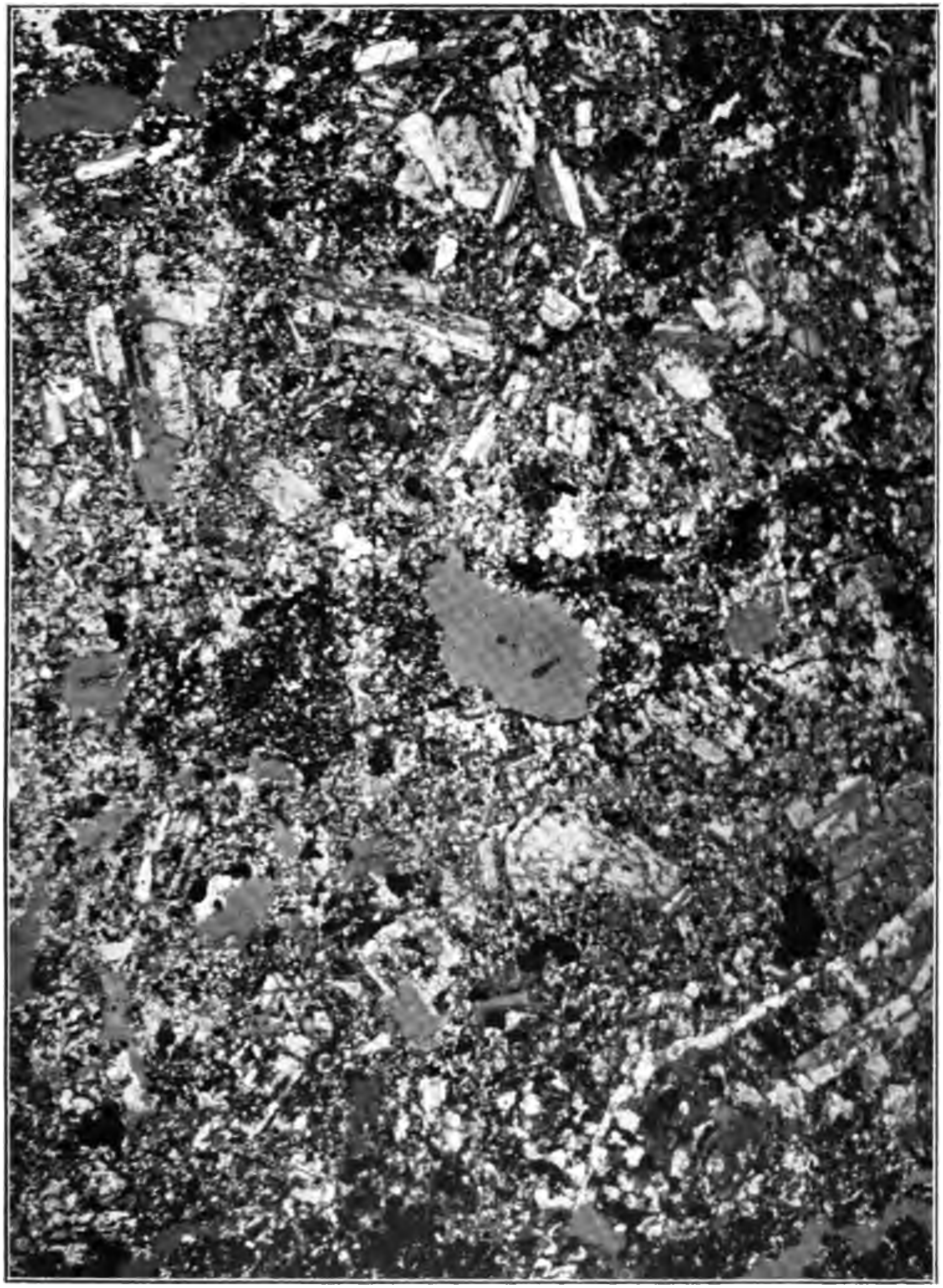
No. 355/836.

M.C.—Light-grey rock, with white felspar phenocrysts.

U.M.—MATRIX: Quartz in irregular mosaic of various degrees of fineness, poorest where coarsest; where finer, with an admixture of a kaolin-like mineral. Leucoxene and iron-pyrites scattered.

PHENOCRYSTS represented solely by pseudomorphs.

Felspar: Rather large, fairly numerous; consist of kaolin and mica, the mica frequently marking out the original cleavage-lines, which cross one another sometimes at right angles; some pyrites may be present.



No. 354/833. PYROXENE ANDESITE.

[To face p. 110, Vol. II.

Pyroxene : Somewhat small crystals, with traces of 110, 100, 010, forms consisting of quartz, a mica-like material, and pyrites.

Hornblende may possibly have been present; some axially striated pseudomorphs containing leucoxene suggest it.

Quartz in large corroded grains, of which but a few.

Altered Pyroxene Dacite, or Pyroxene Rhyolite.

Locality.—The Chicago Claim, upper part of Tararu Creek, Thames district.
Formation.—Thames-Tokatea group.
Remarks.—The Chicago reef occurs in rocks that may be considered the highest in sequence and the youngest of the Thames-Tokatea group in the Thames district.

No. 356/846.

M.C.—Dark-grey to black rock, with large phenocrysts of felspar, and small ferro-magnesian platy structure, and dendrites of manganese-dioxide on the partings.

U.M.—MATRIX crowded with plagioclase laths in stream-lines immersed in colourless glass. Small prisms and grains of pyroxene are also present, and universally disseminated octahedra of magnetite. Here and there are streaks of micropœcillitic structure. Matrix more than half the rock.

PHENOCRYSTS.—*Plagioclase :* Numerous fresh crystals, some poor in inclusions, others filled with long parallel threads of glass; ext., 20°/20° (andesine); zonal.

Augite : Fairly abundant in somewhat small crystals, some very small, some large, frequently grouped, and occasionally small crystals in rosette-like clusters.

Hypersthene : Usual pleochroism, salmon-pink / bluish-green, well marked, quite fresh, about as abundant as augite. Large crystals of hypersthene and augite occur in association with large crystals of plagioclase.

Magnetite in large grains, rare.

Hyalopilitic (in places micropœcillitic) Hypersthene Andesite.

Locality.—The Thames district, exact locality uncertain.
Formation.—Beeson's Island group (?).
Remarks.—The specimen was contributed by a Thames collector as a sample beautifully marked with dendrite, but the collector was unable to give the locality of the specimen.
The specimen probably came from the Kauaeranga Valley or the hills between that and Hape Creek.

No. 357/847.

M.C.—Greyish rock, with chalk-white spherulites.

U.M.—A perlitic glass transformed into a quartz mosaic. The glass had undergone a certain amount of alteration before the introduction of the quartz, as is shown by a dusty band of uniform thickness bounding the perlitic cracks on each side, but the altered material as well as the fresh glass has been completely transformed. The quartz contains a great number of colourless transparent crystals of lower *r.i.* than itself; these may be felspar, perhaps orthoclase. The spherulites end sharply against the replaced glass, and are not mosaicised, but grains of secondary quartz occur in them sporadically. They are also fractured, both radially and tangentially, chiefly radially, and the cracks are filled with quartz mosaic. Some are broken into fragments, which float separately from each other in the mosaicised matrix.

Altered trichites, reduced to rows of granules, run in stream-lines through both the matrix and the spherulites. They are white, like leucoxene, and present only sparingly.

The spherulites have the usual characters of the positive kind.

PHENOCRYSTS.—*Soda Orthoclase:* Crystals resembling orthoclase are sparingly present; between *z.n.* they are seen to be composite, with two components. On 010 one of these extinguishes at 7° with the edge 010, 001, and at 23° with the edge 110, 010; the other extinguishes at 130° with the edge 010, 001. The felspar is sometimes brecciated.

Quartz: Several large corroded grains are present, one much broken up, brecciated by the matrix. The quartz and the felspar offer a nucleus for spherulitic growths.

Ilmenite: Several plates altered into leucoxene.

Spherulitic Rhyolite, with a perlitic glassy matrix now converted into quartz mosaic.

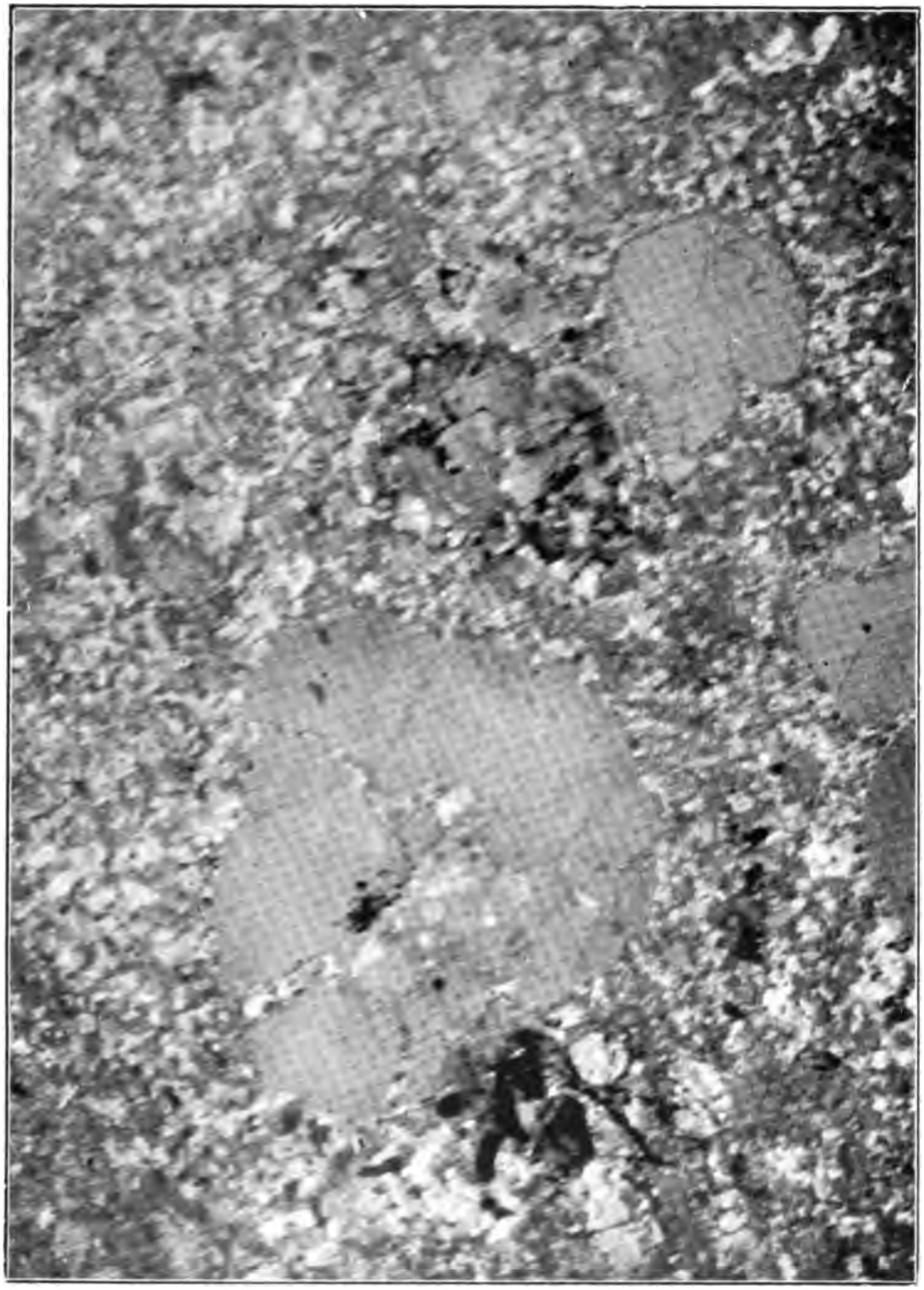
Illustration.—Slice affords but medium or poor contrasts with ordinary transmitted light.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower right, which shows a spherulitic outline in the lower right of the reproduction.

Locality.—Waihi Beach Claim, Waihi Beach, Ohinemuri County.

Formation.—Acid group of Pliocene age.

Remarks.—The specimen is from the hanging-wall of the auriferous lode being prospected at Waihi Beach. The foot-wall seems to be a different rock, and the lode seems to occur between Beeson's Island rocks and the rhyolites of Pliocene age.



No. 357/847. SPHERULITIC RHYOLITE.

[To face p. 112, Vol. II.

No. 358/853.

M.C.—White fine-grained porous rock, looking like chalk.

U.M.—A fine-grained tuff, composed of fragments of glass of characteristic "ash" form, angular chips and "bones," with hydrated margins and flow-streaks, which stain deeply with fuchsine.

Angular chips, splinters, and dust of felspar, some of which is plagioclase, stream through the slice, as well as other indeterminable minerals.

Consolidated Rhyolitic(?) Ash.

Locality.—Kauaeranga Valley.
Formation.—Acid group of Pliocene age.
Remarks.—The rock occurs in considerable quantities in the Kauaeranga River bed, and has its source from the north side of the upper part of the valley east and west of Table Mountain. The rock overlies the pumiceous agglomerate of the upper Waiwawa and Rangihau Valleys, but it is seldom seen so white or so fine in the grain as the specimen described except on the Kauaeranga River bed.

No. 359/863.

M.C.—Brownish-grey and dark-green rock, with white spherulites.

U.M.—MATRIX: None. The rock is a mosaic of spherulites, and the dark-green substance seen in the hand-specimen is formed of the outer part of the white spherulites. The spherulites are positive, of the usual kind, but with several very interesting features. They vary much in size; some are simple, others composite. A nucleus of one kind or another may, or more often may not, be present. The form and growth are often very regular. The nucleus when present may be a plate of biotite with a little fine-grained quartz mosaic, or—and this is the more interesting case—it may be a micropegmatitic intergrowth of quartz and felspar, from which several brushes of a spherulite may proceed, each from a separate point. The hope naturally arises of being able to trace some of the fibres of the spherulite into continuity with the felspar threads of this micropegmatite, but it is disappointed. The boundaries of the micropegmatite though irregular are sharp, and absolutely cut off from the spherulitic fibres; nor does the direction of the felspar in the micropegmatite seem to exert any influence on the direction of the threads of the spherulite.

The spherulite, as so frequently happens in other instances, is divided by a concentric circle into two parts, a central and a peripheral; but in this case a marked difference frequently distinguishes these two regions, the outer being rich in trichites and black rod-like crystals (white, or with white margins, by reflected light), which are either entirely absent in the central area or much less richly present. In many cases the distinction is absolute, the black rods taking their origin from the inner margin of the peripheral zone. As to the nature of the black rays, I take them to be some kind of titaniferous iron-ore, and their presence in the exterior zone is in consistence with the law of concentration of the iron in the latter consolidating portions of the magma. The abruptness of the change in character of the spherulites is, however, not a little interesting. The spherulites have begun to undergo alteration, the change proceeding from the centre outwards, and sometimes stopping at the boundary between the central and peripheral region. Were it not, therefore, for the presence of the black rods the distinction between these two regions might be regarded as merely the result of a difference in regard to freshness or alteration.

The decomposition of the spherulites affects one set only of the two groups of fibres of which they are formed, and since the alteration product stains with fuchsine it is possible to distinguish between the two with ease. It is probably the glass which suffers first, the felspar resisting longer. The structure of the spherulites is evidently far from being simply radiate; the different radiate pencils of which they are composed frequently cross one another when adjacent, giving the appearance of a felt.

The interstices between the spherulites vary in size and infilling. Sometimes the adjacent spherulites are so close as to leave no noticeable interspace. At other times a narrow cavity remains, which is filled in with a marginal border of hydrated glass and a central mosaic of quartz; sometimes the hydrated glass and sometimes the quartz is in excess. In some cases glass and quartz form a labyrinthine intermixture.

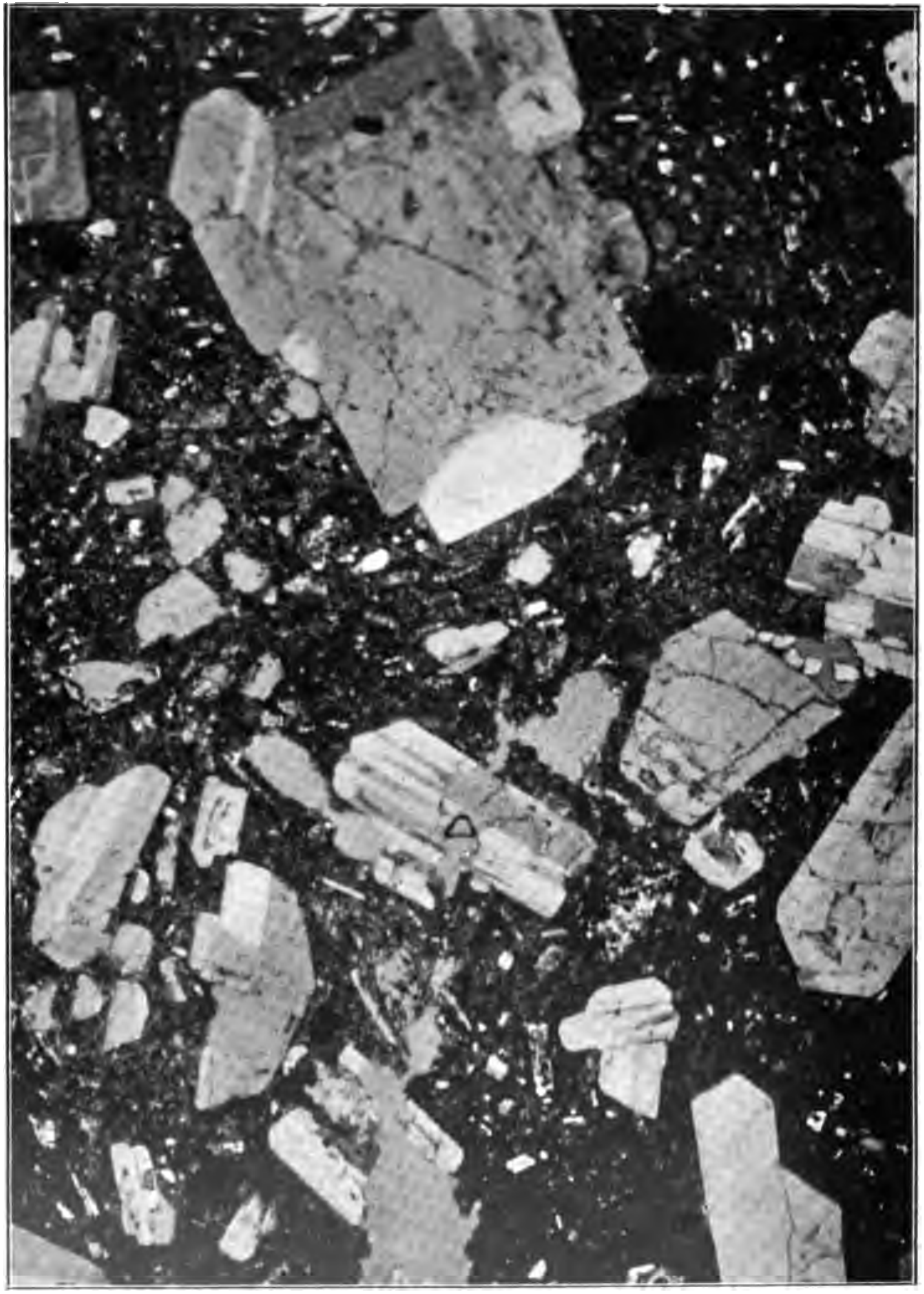
The structure of the spherulites becomes coarser towards the periphery, till at length the felspar rays can be readily distinguished from the intervening glass; the latter has a much lower *r.i.* than the felspar, and is crossed by the bluish lines which have previously been mentioned as occurring in it. This "glass" is probably identical with the anisotropic substance otherwise resembling glass, the precise nature of which is still undetermined.

Spherulitic Rhyolite.

Locality.—Hihi Stream, Kauaeranga Valley, Thames County.
Formation.—Acid group of Pliocene age.
Remarks.—This specimen was obtained from the source of the stream above where the track to Tairua leaves the bed of the creek. It was doubtful whether the rock occurred *in situ* or not; but in any case a short distance farther to the east or higher in the range must show the acid rocks in the solid.

No. 360/878.

M.C. · Bright- almost chrome-green rock, porphyritic, with large crystals of felspar frequently stained green and large black crystals of hornblende.



No 360/878. QUARTZ HORNBLENDE PYROXENE ANDESITE.

[*To face p. 115, Vol. II.*

U.M.—Matrix: Plagioclase laths and rectangles, the latter often with a core of glass, not very plentiful; abundant granules, scales, and pseudomorphs of vivid green chlorite; a little quartz, magnetite grains of very various size, and "glass," often accumulated in little pools, and divided into polygonal areas by green lines like the "glass" in many rhyolites. Some large crystals of apatite are also present.

Phenocrysts. — *Plagioclase:* Large and numerous crystals, variously twinned, glassy-clear when free from inclusions; ext., 30°/30° (labradorite); zonal. Inclusions colourless glass, each with a large spherical bubble, hornblende, chlorite, magnetite, and apatite. Some crystals very poor, some rich in inclusions.

Pyroxene represented by not very numerous pseudomorphs in vivid chrome-green chlorite, with which a faint honey-yellow chlorite of high double refraction may be associated.

Hornblende: Fairly numerous crystals, fresh, without marked reaction border, pleochroism yellowish-brown / brownish-yellow; ext., 8°; twinned once or twice.

Magnetite: Fairly numerous grains.

Quartz: Several large corroded fragments, one containing vivid-green chlorite after pyroxene. The presence of primary quartz in a rock rich in labrador is interesting. There is no aureole of augite around this quartz to suggest a derivative origin, as in the case of the quartz-bearing basalt described by Diller.

Quartz Hornblende Pyroxene Andesite.

Illustration.—Slice shows good contrasts in the different parts, and specially in that which has been photographed.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper middle, which fairly represents the rest of the slice.

In the reproduction the phenocrysts are well rendered, the matrix not so clearly.

Locality.—The Kauaeranga River bed.

Formation.—Beeson's Island group (?).

Remarks.—This rock is not plentiful, but fair-sized boulders of it are occasionally found in the river-bed. The rock is such that it could possibly be part of Table Mountain dyke, or the same where it crosses the Hihi Stream, but the colour of the rock is such as has not been observed in connection with the rocks *in situ* or evidently derived from this great intrusion. The Kapanga rocks possibly present on the north side, and probably so on the south side, of the Kauaeranga watershed might afford such rocks as the specimen, but the far greater probability is that this is a rock of the Beeson's Island group.

No. 361/881.

M.C.—Green tuff, containing lapilli.

U.M.—Characteristic colourless glassy fragments like those of No. 794, altered at the margin, interstices filled with fine chloritic dust. Fragments of altered pumice, of the groundmass of rhyolites and andesites, of crystals of felspar, chiefly plagioclase, and rarely quartz and magnetite.

Volcanic Ash and Lapilli; probably derived from an acid magma(?).

The andesitic material may be derived from older rocks; on the other hand, it would seem that we possess no ready criterion for distinguishing acid from basic glass.

Locality.—The Kauaeranga River bed.
Formation.—Acid group of Pliocene age.
Remarks.—Derived from the main range containing the east and south-east sources of the river.

No. 362/899.

M.C.—Purple hornstone-like matrix, with crystals of felspar and quartz.

U.M.—MATRIX: Abundant, forming far more than half the rock, crowded with minute felspar laths of very uniform size in stream-lines, and some larger ones, numerous grains of magnetite, all immersed in a colourless glass, which frequently forms irregular streaks running with the stream-lines, or expands into large pools. It is sometimes divided into polygonal areas by a reticulum of green lines, and in the large pools shows a mosaic-like structure, each grain with fibrous striation.

PHENOCRYSTS.—*Plagioclase:* Crystals, clusters, and fragments, some almost free from inclusions, some crowded with negative glass crystals; *r.i.*, above balsam; ext., 27°/ 32°, 28°/ 35° (labradorite); variously twinned.

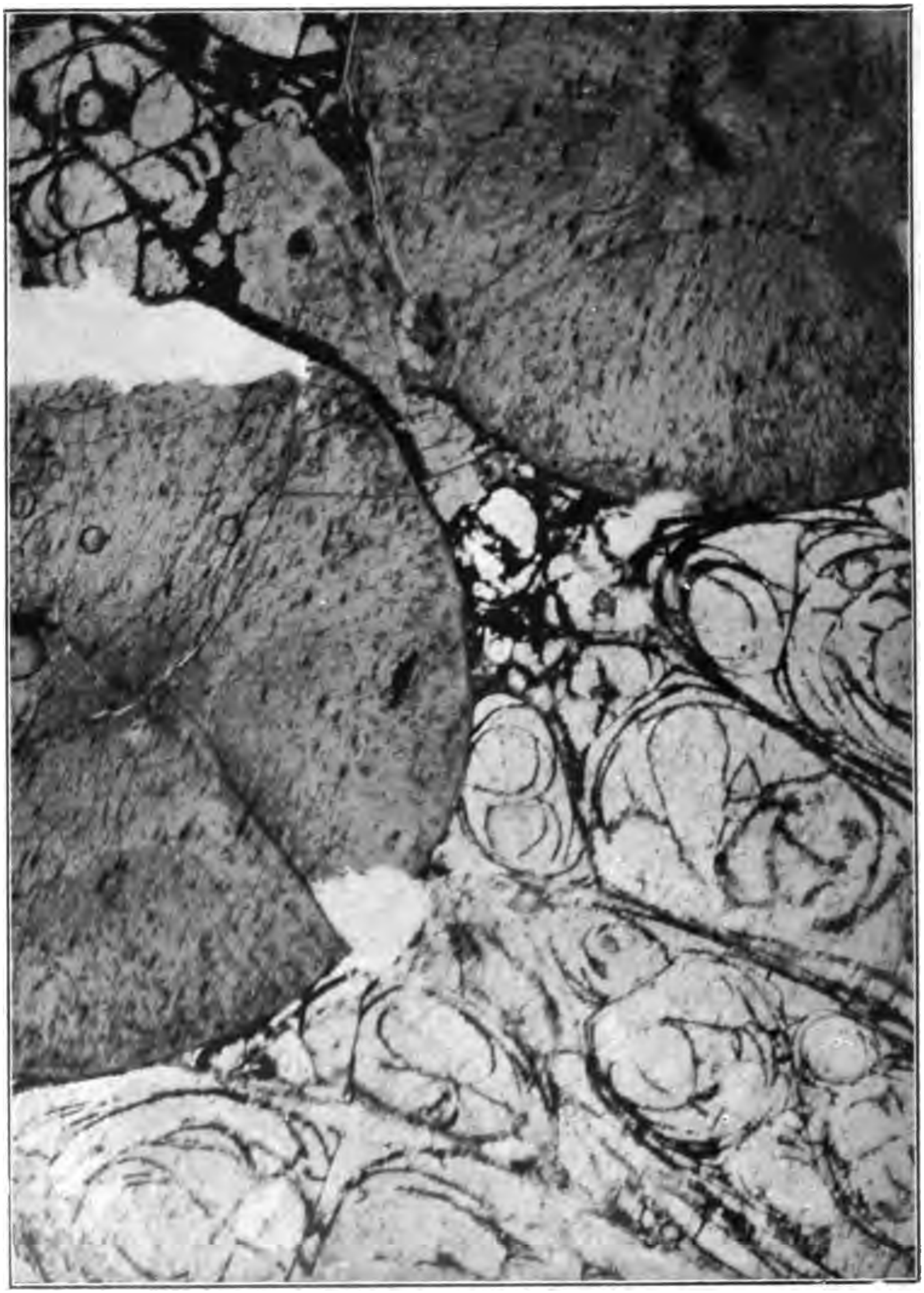
Augite: Well-formed crystals and mosaic clusters, associated with plagioclase, extinction up to 43°, faint greenish tint; in some cases attacked by the matrix, so that all the original material is removed, and its place taken by glass and quartz mosaic, with sometimes magnetite. The glass in some cases filled with spherules of opal. (May this altered pyroxene have been hypersthene?)

Hornblende: A few largish crystals and corroded fragments; reaction border when present thin, ruddy-brown / greenish-yellow; ext., 8°; recalls hornblende in No. 878.

Quartz: A few corroded grains and bi-pyramids.

Ilmenite in hexagonal plates, with associated apatite.

The different kinds of phenocrysts occur sometimes in groups associated together.



No. 363/911. PERLITIC GLASS.

[To face p. 117, Vol. II.

At one end of the slice a streak occurs containing more glass than the rest and displaying small spherulitic growths.

Hyalopilitic Hornblende Pyroxene Dacite, or **Quartz Hornblende Pyroxene Andesite,** rich in glass.

Locality.—The Kauaeranga River bed.

Formation.—Acid group of Pliocene age.

Remarks.—The specimen was collected under the belief that it belonged to the acid group of Pliocene age. The description, however, does not bear out that conclusion. Nevertheless, as it is megascopically unlike any rock from the Beeson's Island or the Thames-Tokatea groups in the same or immediate district it has still to be considered a rock of the acid group.

No. 363/911.

M.C.—Brown spherulites, some hollow and lined with quartz, in a streaky perlitic glass.

U.M.—MATRIX: Colourless glass, with crystallites running in straight or wavy or inflected stream-lines; perlitic cracks occur throughout the glass. The crystallites are chiefly trichites, straight and simple, or curved or zigzagged or in radiate groups; belonites are present also, often with swollen ends. Magnetite grains are generally though sparingly distributed. The trichites run through glass and spherulites alike. There are no belonites in the spherulites. The glass is altered on each side of the perlitic cracks into doubly-refracting material, which grows out in tubular prolongations from the cracks into the glass.

Spherulites finely fibrous, positive, of the usual type, with trichites crossing them along stream-lines, and trichite-like fibres running in a wavy radiate manner. In addition to these, others of a more irregular growth and very coarsely crystalline; these incrust a part of the exterior of the more usual spherulites in some cases, and may therefore have formed later in the process of consolidation.

Perlitic Glass, containing positive spherulites.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper right, which is characteristic both as regards the perlitic glass and the spherulites of the other parts of the slice.

Locality.—The Kauaeranga River beds.

Formation.—Acid group of Pliocene age.

Remarks.—Like many others, this specimen was collected from the shingles of the river-bed. Its source in the main range at the source of the river is beyond dispute. This specimen much resembles many collected from Paku Island, where also large spherulites are found floating in a matrix of perlitic glass.

No. 364/912.

M.C.—Black perlitic pitchstone, with phenocrysts of felspar.

U.M.—MATRIX: Colourless glass, perlitic in places, crowded with microliths arranged in stream-lines; the microliths are more densely crowded in some streaks than others. They include transparent prisms or rods with evident double refraction (the belonites of Vogelsang), grains of magnetite, and rarely a prism of felspar with forked ends.

PHENOCRYSTS.—*Plagioclase:* Fairly numerous crystals and fragments; zonal; some singularly free from inclusions; others contain an irregular network of glass or grains of augite or magnetite and apatite. Twinning various; some show no signs of twinning; *r.i.*, above balsam; ext., 12° / 14°.

Pyroxene: Augite very rare, one or two small fragments.

Hypersthene common; the usual pleochroism; magnetite generally associated.

Hornblende: More hornblende than pyroxene, brownish-yellow / deep-brown, almost black; ext., 0° to 3°; elongated prisms, lying with the axes in the plane of the streaming.

Magnetite: Large grains.

Perlitic Glass, containing plagioclase, hypersthene, and hornblende.

Illustration.—Slice shows fair contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower middle part, which shows flow-structure excellently well, but the perlitic character of the glass is but faintly indicated, and in places only.

Locality.—The Kauaeranga River bed, Thames County.

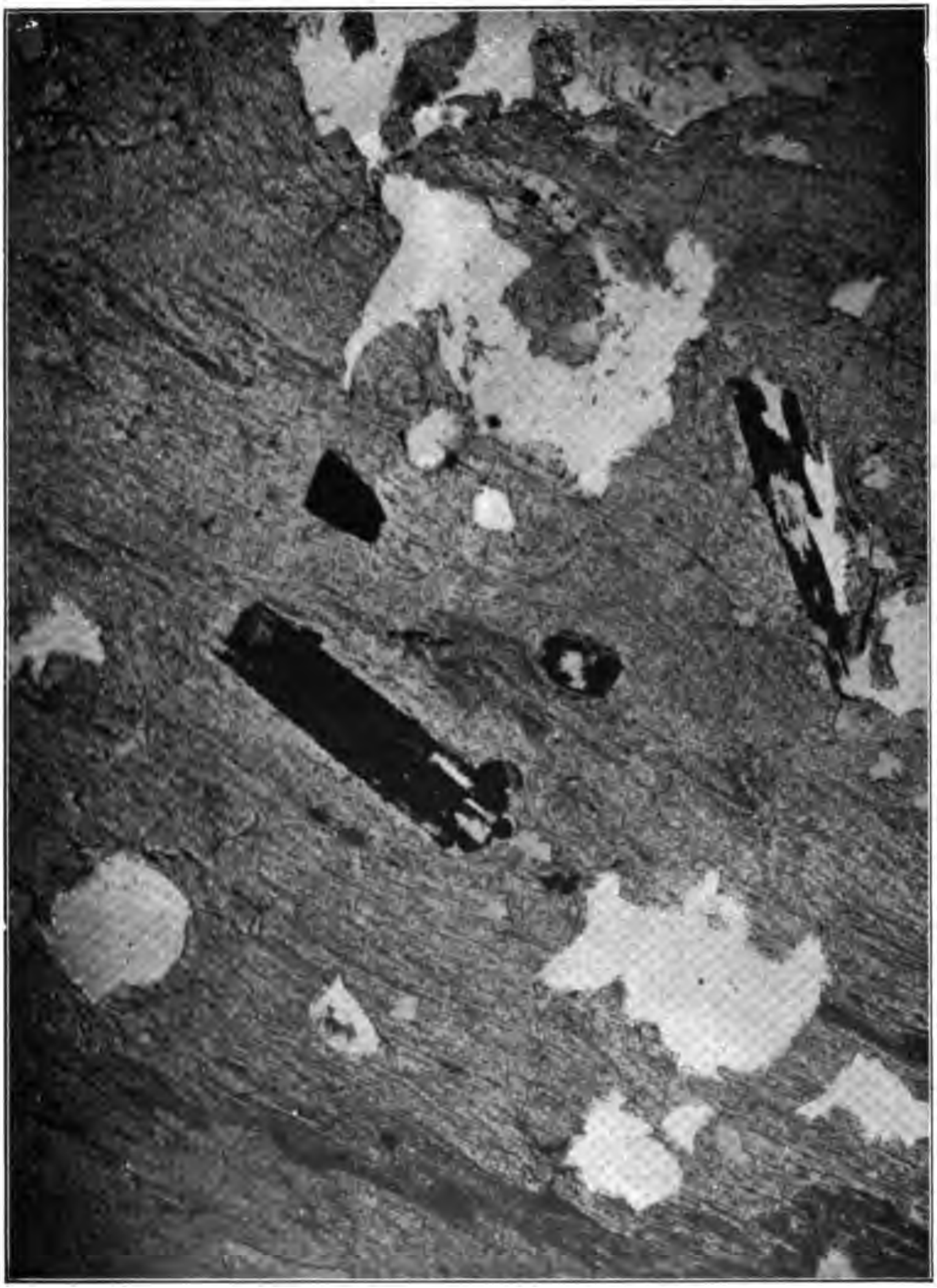
Formation.—Acid group of Pliocene age.

Remarks.—The specimen closely resembles some of the glassy rock from Slip Creek, in the Rangihau Valley.

No. 365/914.

M.C.—Violet-grey dense lustreless rock, with felspar phenocrysts.

U.M.—MATRIX: A felt of felspar laths saturated with colourless glass, here and there micropœcillitic quartz grains and streaks, occasional pseudomorphs in serpentine after pyroxene, scattered magnetite granules.



No. 364/912. PERLITIC GLASS.

[*To face p. 118, Vol. II.*

Phenocrysts.—*Plagioclase* · A fair sprinkling of crystals and fragments; *r.i.*, above balsam.

Pyroxene: A few well-formed crystals and fragments replaced by green serpentine and other decomposition products.

Magnetite: Scattered grains with associated magnetite.

Hyalopilitic (in places micropœcillitic) Pyroxene Andesite.

Locality.—The Kauaeranga Valley, Thames County.

Formation.—Kapanga group (?).

Remarks.—This rock was at first thought to be a rhyolite, but the description leads to the conclusion that it has probably been derived from rocks belonging to the Kapanga group, which are considered to underlie the acid rocks of the main range in and south of the valley of Hihi Stream.

No. 366/923.

M.C.—Greenish-white, with brown spherulites.

U.M.—Matrix perlitic glass, much altered from perlitic cracks inwards, partly into green chlorite, partly into other fibrous decomposition products; contains occasional rectangles of felspar, and pseudomorphs in vivid-green chlorite.

Spherulites of the usual positive kind, fresh, with marked double refraction; include trichites in stream-lines, plagioclase rectangles, resorption pseudomorphs after biotite; frequently elongated axiolitically.

In addition, spherulitic growths of other kinds are present. One group comprises forms which commence as micropegmatitic felspar—*i.e.*, a fibrous intergrowth of quartz and felspar, the outer form of which is in the first instance dominated by the felspar, but subsequently becomes irregular. Spherulites of this kind may occur within the positive spherulites, forming a central nucleus or lying anywhere excentrically. They are readily distinguished, even by ordinary light, by their want of colour, being glassy-clear, colourless, and devoid of inclusions.

Another group of spherulites agrees with the preceding in appearance when viewed by ordinary light, but between *x.n.* shows only very weak double refraction, and under high magnification presents the greenish reticulum already referred to as distinguishing some undetermined substance which might unwarily be taken either for glass or tridymite. To distinguish this it may be provisionally spoken of as *x*. In some cases it seems to be without any action on polarised light. It may occur anywhere, either within the positive spherulites and as if replacing them, or in the interstices between the spherulites.

Spherulitic and glassy flow rock.

Rhyolite, or Dacite Rhyolite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper left, which is characteristic of the rest of the slice.

The reproduction from the photograph is one of the best in the series, but whether the true nature of the matrix and the different kinds of spherulites can be as readily distinguished as they are indicated in the description may be open to question.

Locality.—Kauaeranga Valley, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—The specimen was collected from the river-bed, but it must have been derived from the mountains of the main range south of Table Mountain. With but few exceptions the great bulk of the rhyolites that form so much of the gravels of the Kauaeranga River bed have been derived from the eastern sources of the river, more especially the Billy-goat Stream, the Hihi, and the next source branch south of the Hihi.

No. 367/935.

M.C.—White compact rock, with large phenocrysts of felspar, hornblende, and quartz.

U.M.—MATRIX: Altered glass crowded with small positive spherulites which contain negative fibres also. Glass partly replaced by fibro-foliar growths of quartz. Matrix about half the rock.

PHENOCRYSTS.—*Plagioclase:* Abundant crystals, complexes, and clusters; zonal, and usually lamellar twinned; ext., 16°/ 16°, even when not twinned; *r.i.*, above balsam. Inclusions most commonly negative glass crystals, with bubble.

Hornblende: Large fresh crystals of ferriferous hornblende, scarcely any pleochroism, brownish-yellow to yellowish-brown, extinction observed up to 8°; apatite included. Smaller hornblende crystals pale-yellow / dark-greenish, with indications of resorption border; the ferriferous hornblende shows no reaction border.

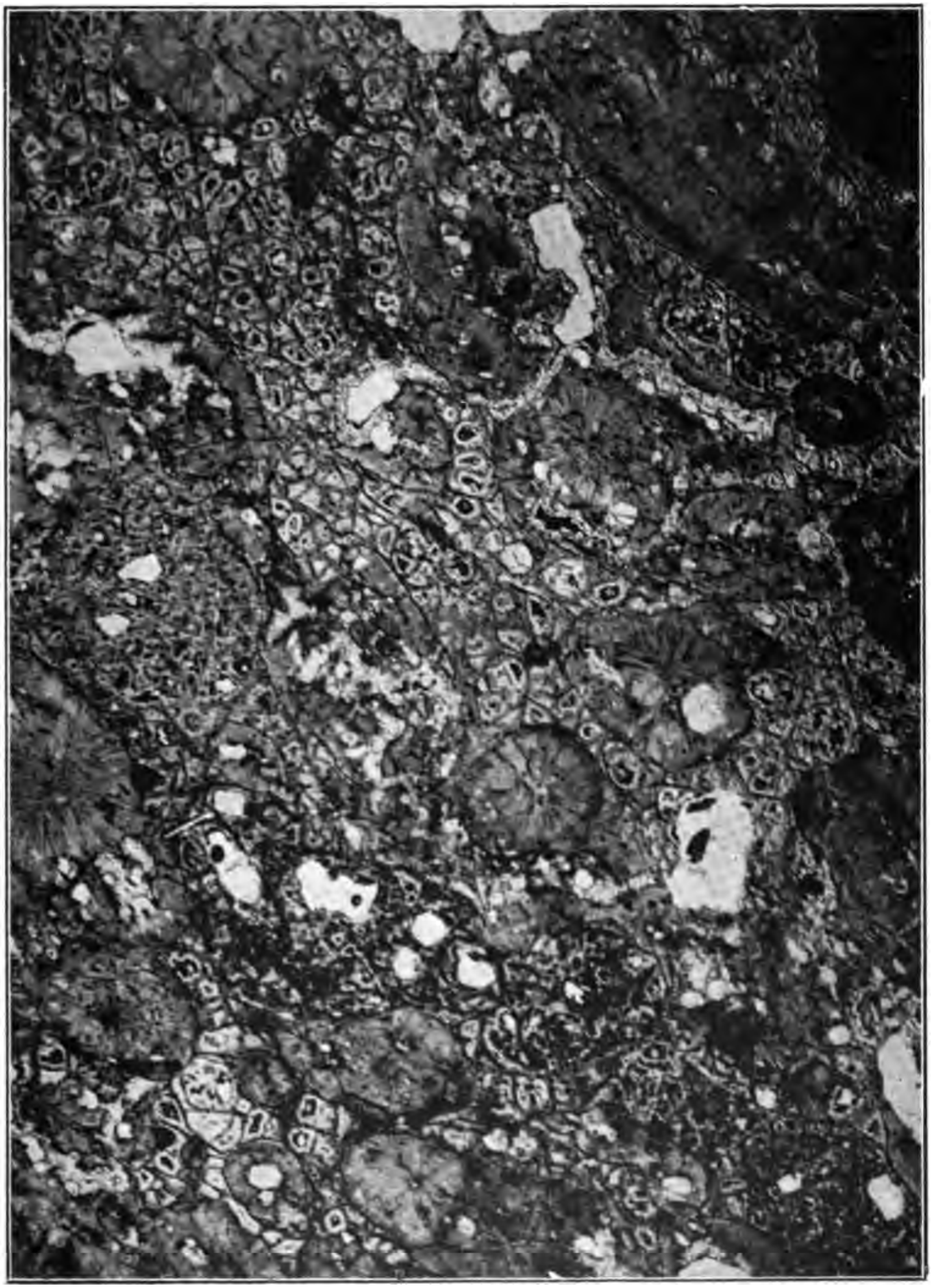
Biotite: A few crystals, corroded, straw-yellow / deep-brown.

Quartz: Large corroded grains, with large glass cavities, the glass in which is partly or wholly replaced by radio-fibrous quartz.

Ilmenite in fairly large hexagonal plates.

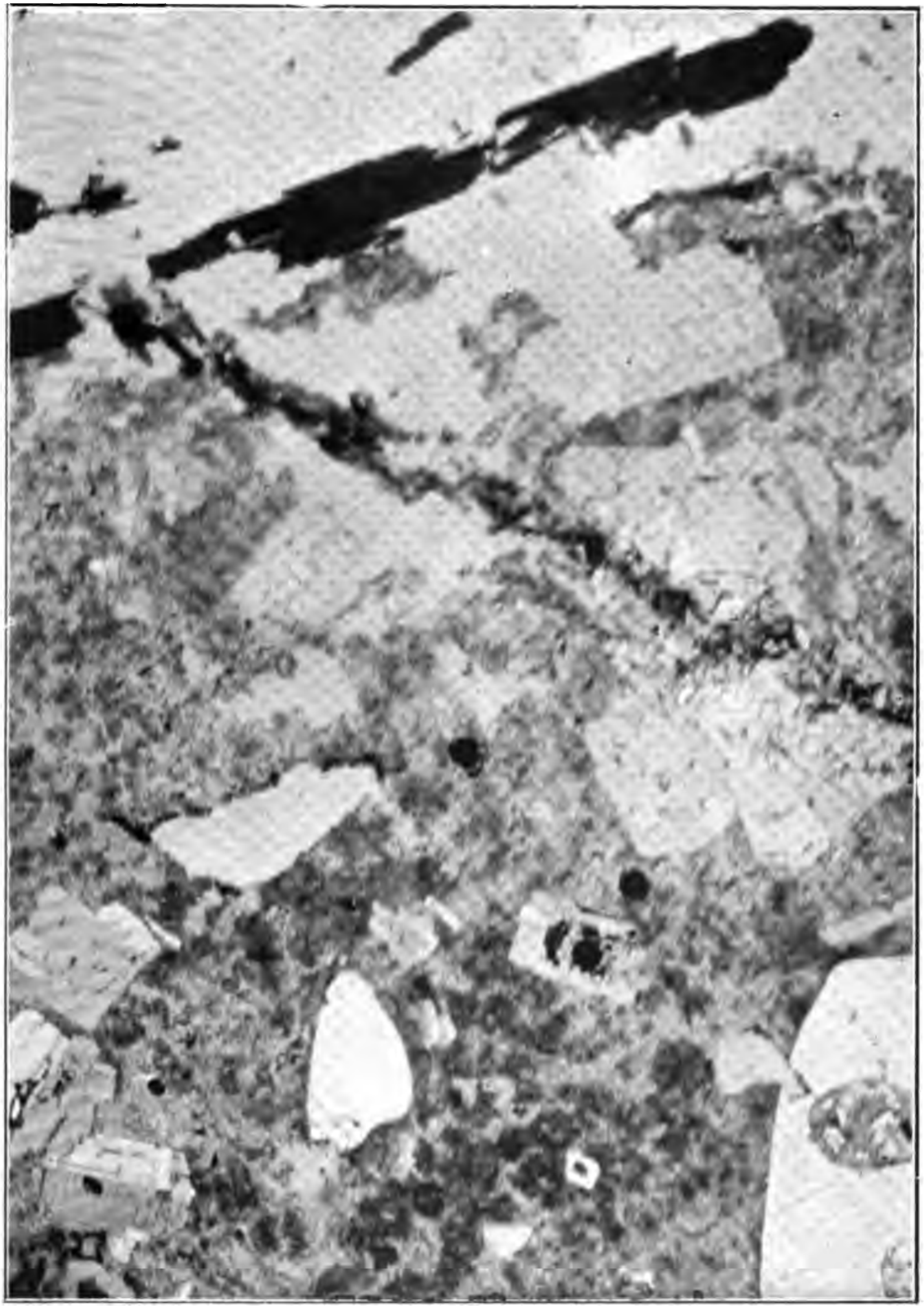
Apatite: Some large striated crystals.

Glassy Hornblende Dacite.



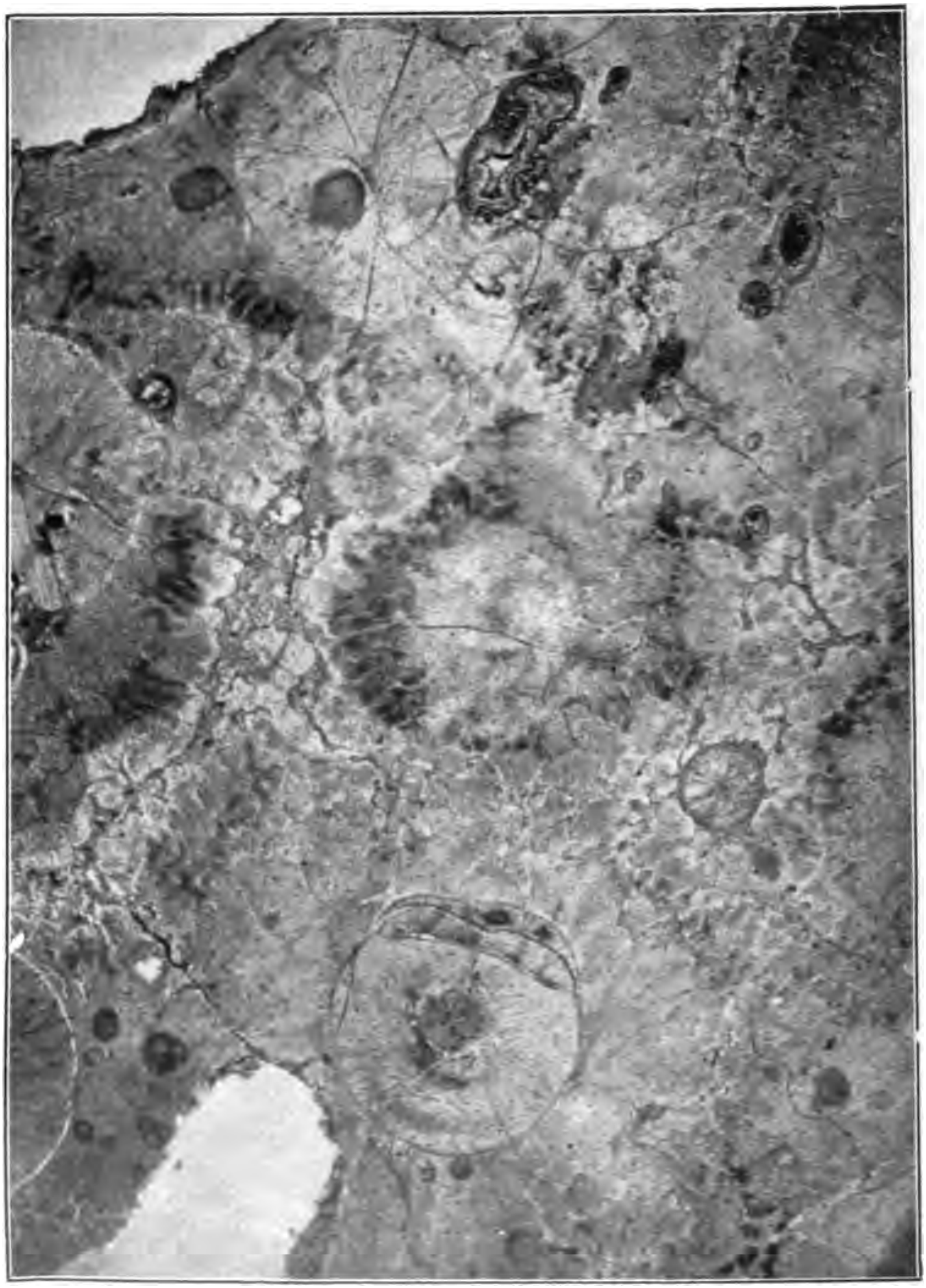
No. 366/923. RHYOLITE OR DACITE RHYOLITE.

[*To face p. 120, Vol. II.*
i.



No. 367/935. GLASSY HORNBLENDE DACITE.

[*To face p. 120, Vol. II.*
ii.



No. 368/942. RHYOLITE OR DACITE RHYOLITE.

[*To face p. 121, Vol. II.*

Illustration.—Slice shows good contrasts, but the reproduction from the print is not possessed of sufficient vigour.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper left, which, with the exception of the long rod-like bodies present in this part of the slice—one of which shown in the upper part of the illustration—is characteristic of the rest of the slice.

Locality.—The Kauaeranga Valley, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—Collected from the river-bed, but derived from the mountains of the main range lying between the eastern sources of the Kauaeranga and the lower valley of the Tairua River.

No. 368/942.

M.C.—Vesicular rhyolite, spherulitic, vesicles lined with small crystals and hyalite.

U.M.—Matrix: Perlitic glass, much altered inwards from perlitic cracks into green fibrous chlorite and other decomposition products; of this there is very little, the mass of the rock consisting of spherulitic growths. Some of these are regular, round, almost colourless, positive spherulites of the usual kind with well-marked double refraction; the remainder is browner, less angular, with coarse broad foliar rays; this surrounds the regular forms, sometimes completing their growth, sometimes taking origin afresh from periphery or from the walls of the vesicles of the rock; sometimes also it forms the central part of a regular spherulite; it generally completes its growth in short rounded lobate processes. Small vesicles are included in this here and there, either empty or filled with quartz. Trichites in great variety are preserved in the spherulitic substance of both kinds, some running with the stream-lines, and others, curious to say, athwart them; these latter are of remarkable length and much undulated. In the regular spherulite, in addition to radial trichites and those following stream-lines, one sometimes encounters others running in a wide-angled spiral from the centre outwards. The vesicles of the rock contain crystals of tridymite, and a radio-fibrous zeolite, which is sometimes converted into opal.

Vesicular spherulitic flow rock, with perlitic glass.

Rhyolite, or Dacite Rhyolite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which is characteristic of the rest of the slice where perlitic cracks are not very abundant.

The degree of magnification does not suffice to show the abundance and disposition of the trichites mentioned in the description. Had the power used been sufficient to do so a quite different and a less characteristic illustration would have been the result.

Locality.—The Kauaeranga Valley, about three miles from the mouth of the river, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—Except along the Hihi and Waiwawa Streams none of the rhyolitic specimens from the Kauaeranga watershed were obtained *in situ*, and in all cases in which the locality is not particularly mentioned the specimen may be referred to the mountains within which lie the eastern sources of the river.

No. 369/950.

M.C.—Yellowish-grey hornstone-like glass, containing brown spherulites, which where most abundant are hollow and replaced by quartz.

U.M.—Perlitic glass, much altered from the perlitic cracks inwards, and very variously, the different "pearls" showing differences amongst themselves. Thus in one case an almost complete replacement by a mosaic of quartz may have occurred, in another by chalcedony, its fibrous growth mimicking the positive spherulites, of which also the remains are found in some, while in yet others the glass may retain its original character. In some cases the glass contained transparent, colourless, skeleton crystals, which have survived a replacement by quartz. Some are without inclusions, many contain trichites in stream-lines, or an occasional felspar rectangle. As usual, a green chloritic fibrous band, running out into minute spherulitic forms, adjoins the perlitic cracks.

The spherulitic growths of the usual positive kind; they contain trichites both straight and curved, simple and radiating, following stream-lines, as well as others also which are disposed radiately. Magnetite grains are also present.

The phenocrysts are plagioclase, sometimes in very long rectangular sections, which may be repeatedly broken across and slightly displaced, also bipyramids of quartz. The phenocrysts are not numerous.

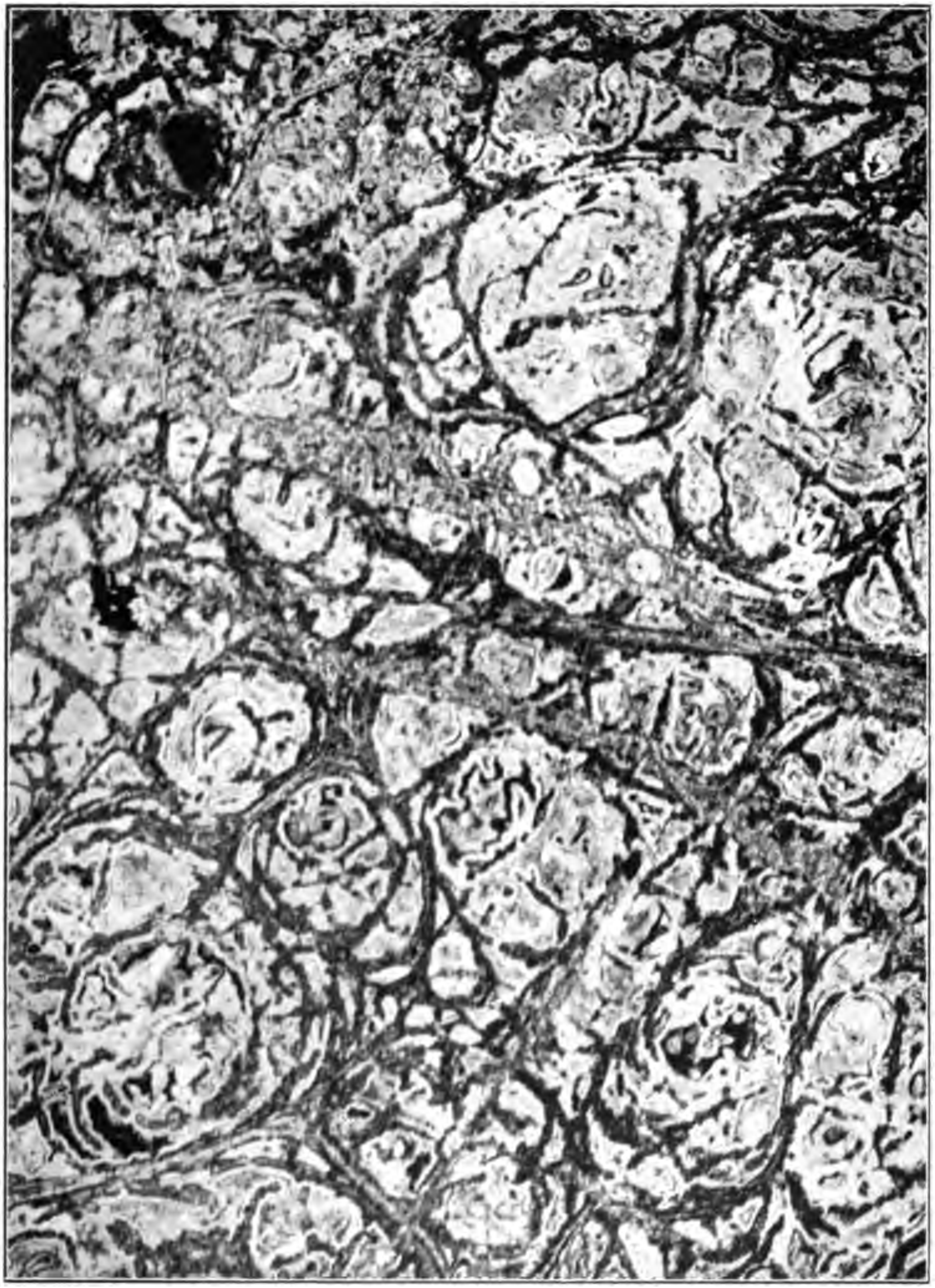
Glassy and **Spherulitic Rhyolite,** containing plagioclase.

Illustration.—Slice shows moderate contrasts; the reproduction from the print, however, has strength with a fair amount of detail.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower right, which not showing spherulites nor phenocrysts is thus scarcely characteristic of the rest of the slice except in the particular of the manner of their occurrence and the peculiarities of the perlitic rendings.

Locality.—The Puriri River where it enters the higher hills bounding the upper part of its valley, Thames County.

Formation.—Acid group of Pliocene age.



No. 369/950. GLASSY AND SPHERULITIC RHYOLITE.

[*To face p.* 122, *Vol. II.*

Remarks.—This rock has been derived from the mountains of the main range on the south-east side of the Puriri Valley, such rocks not being present in the banks of the stream where the specimen was collected. This and several other samples were taken from a travelled block some 3 ft. in diameter, which showed spherulites, in some places abundantly, in a glassy rock, the perlitic structure of which could be easily made out without the aid of a lens. In places the spherulites were clustered together almost to the exclusion of the perlitic glass, or with quartz associated they lined cavities of considerable size. Had the slice shown any of the larger spherulites, for the more complete illustration of this rock a second micro-photograph would have been taken.

No. 370/976.

M.C.—Lithoidal flow-rock, in black and white streaks, with small phenocrysts of felspar.

U.M.—Finer and coarser crystalline streaks, consisting of felspar and *x*, with magnetite granules and occasional felspar laths. The finer resembles negative spherulitic material, and shows signs in places of axiolitic or spherulitic structure, but is mostly confused. The coarser has the usual character, consisting of felspar crystals and *x*, the latter sometimes replaced by quartz; sphene and biotite occur in micropœcillitic growths in it here and there.

The phenocrysts of plagioclase have *r.i.* above balsam; ext., 25°/28°; they are fairly numerous and well formed. The altered remains of pyroxene are sometimes associated with them. Magnetite and ilmenite occur with associated apatite. There are no rhyolitic quartz grains.

Dacite or **Soda-rhyolite,** with flow-structure.

Illustration.—See Vol. i., page 98.

Photographed by reflected light; magnification, 10 diameters; area photographed being characteristic of the whole specimen.

Locality.—Puriri River, where it emerges from the hills bounding the upper part of the valley, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—This rock closely resembles a rhyolite found plentifully along the east shore of Lake Taupo, and noted by Hochstetter in his work on "New Zealand," page 385. This correspondence in the character of the rocks is not a proof that they are of the same age.

No. 371/991.

M.C.—Black, compact rock, with large phenocrysts of colourless plagioclase with glassy lustre.

U.M.—Matrix: A clear brownish glass crowded with long felspar laths, prisms of pyroxene, and minute crystals of magnetite, in stream-lines. Thin plate-like crystals, such as were described under No. 366/923, are scattered through the glass. Here and there the glass is much poorer in microliths than elsewhere.

Phenocrysts.—*Plagioclase:* Numerous crystal complexes and fragments, some broken in place, and the space between the parts filled with brown glass and microliths; some corroded by matrix. Inclusions various, some crystals poor in inclusions, others filled with brown glass in long negative crystals, also zonal inclusions of brown glass from almost ultra-microscopic minuteness up to large negative crystals with a large bubble, or a spherule of iron-oxide; ext., 20°/20° to 32°/34° (andesine and labradorite).

Augite: Numerous generally small and fragmentary crystals, brownish-yellow to greenish tint.

Hypersthene: Larger crystals than those of augite, usual pleochroism, quite fresh, some surrounded by a very thin envelope of augite. Contain intruded glass of the matrix.

Hornblende: Small resorption pseudomorphs, not numerous.

Magnetite: A fair number of large grains.

Quartz: Several rounded and corroded grains.

Hyalopilitic Quartz Hypersthene Andesite.

Illustration.—Slice shows good contrasts. Two photographs were taken, both of which have been reproduced.

Photographed by polarised light; magnification in both cases, 33 diameters; areas photographed, middle and lower middle parts contiguous to each other. Both are rather remarkable, and for this reason the two prints have been given in illustration of the specimen and slice. In *a* a large phenocryst has been ruptured and separated for a short distance, the space being now filled with matrix; in *b* the phenocrysts are interesting, but the matrix is not so sharply rendered.

Locality. — West side of Table Mountain, at the source of the Waiwawa River, Thames County.

Formation.—A massive dyke intrusion of later date than the acid group of Pliocene age.

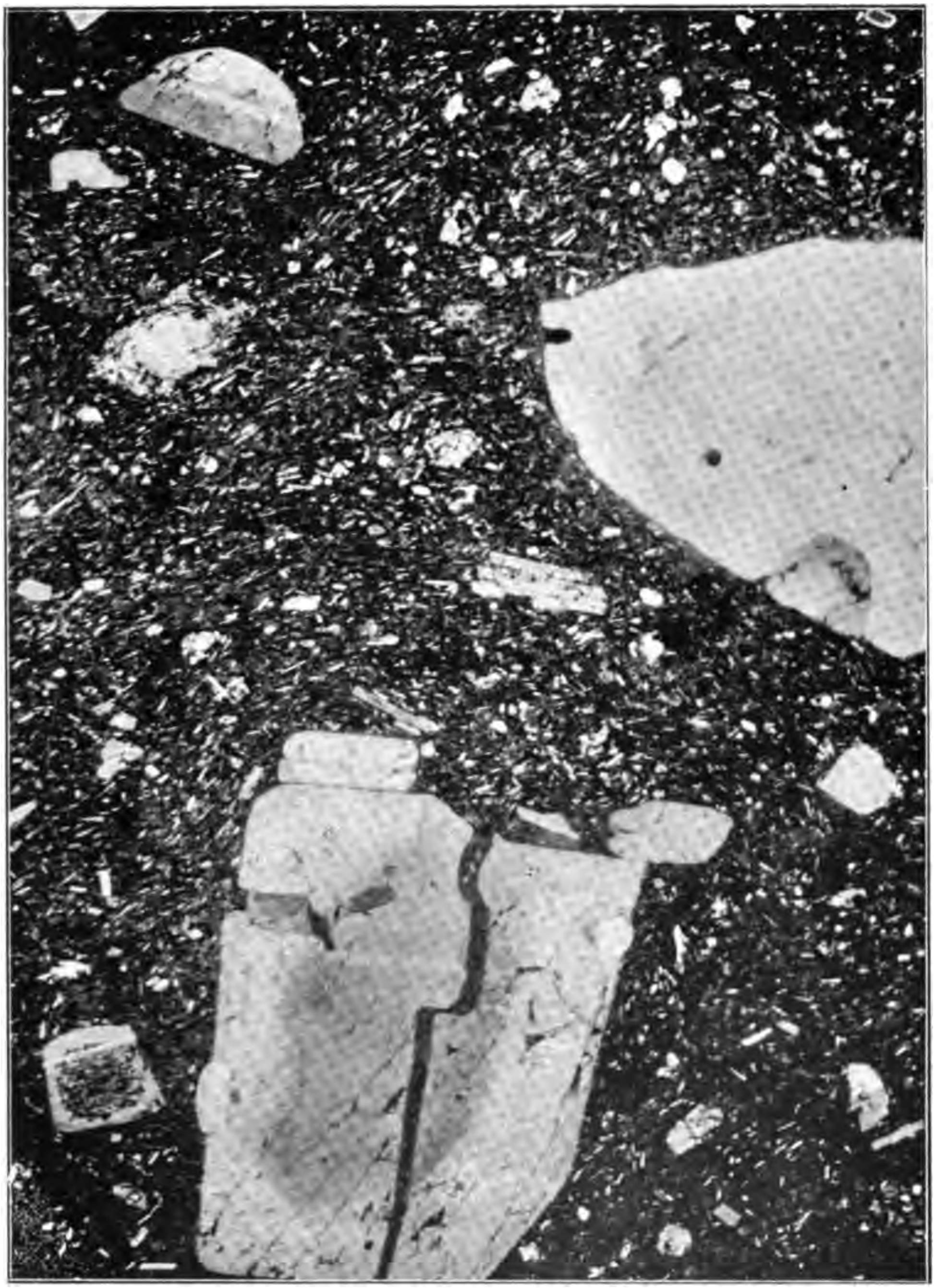
Remarks.—Table Mountain on three sides presents vertical cliffs 400 ft. to 800 ft. in height. On the east side a considerable amount of broken rock lies at the foot of the cliff; yet from the nearness of the pumiceous agglomerate, through which the more basic rock has reached the surface, it is evident that on that side inside its walls the dyke has not been much encroached on by atmospheric denudation.

No. 372/994.

M.C.—Similar to 991.

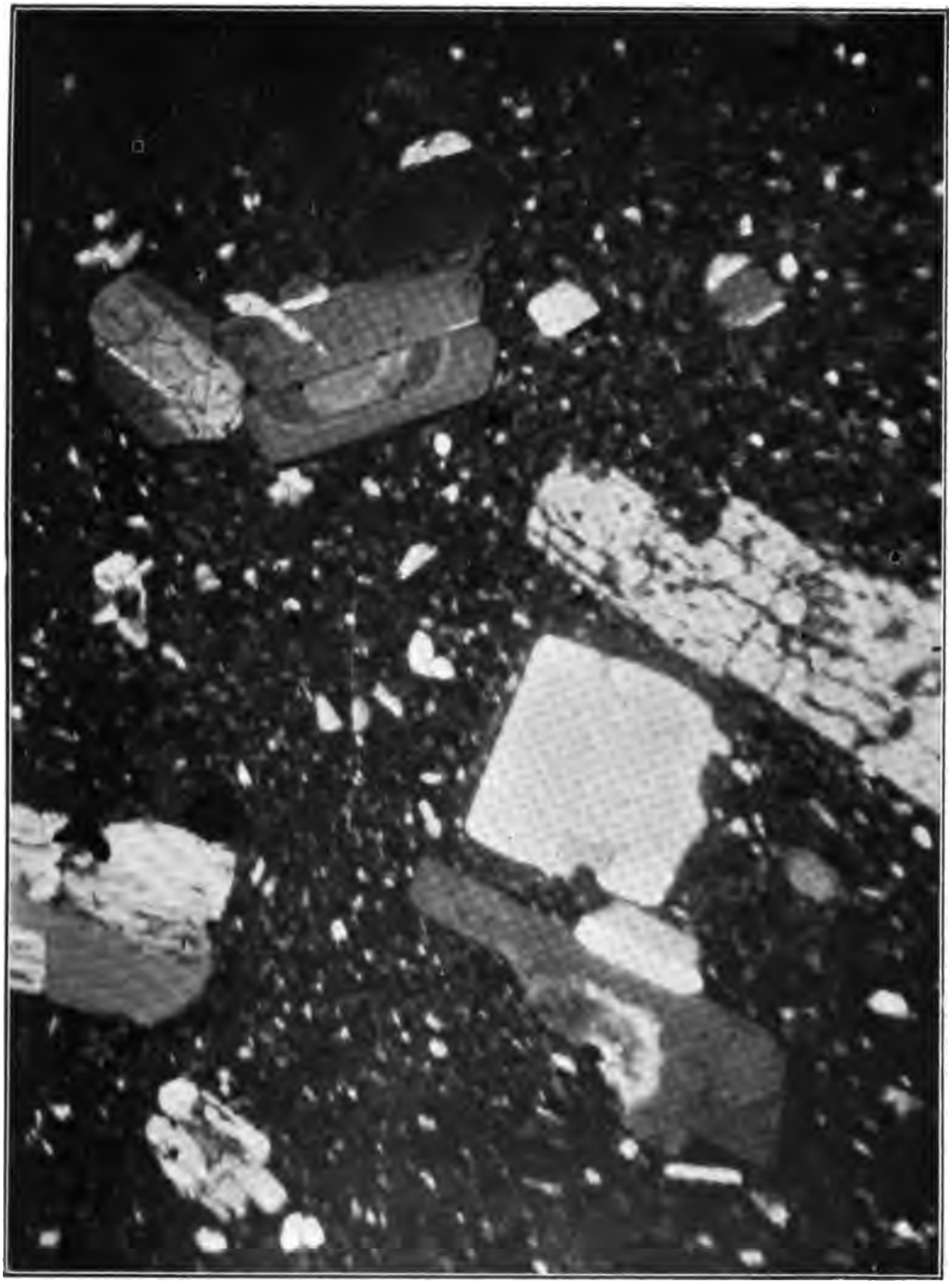
U.M.—In every important detail this rock agrees with 991. Apatite is associated with the magnetite.

Hyalopilitic Quartz Hypersthene Andesite.



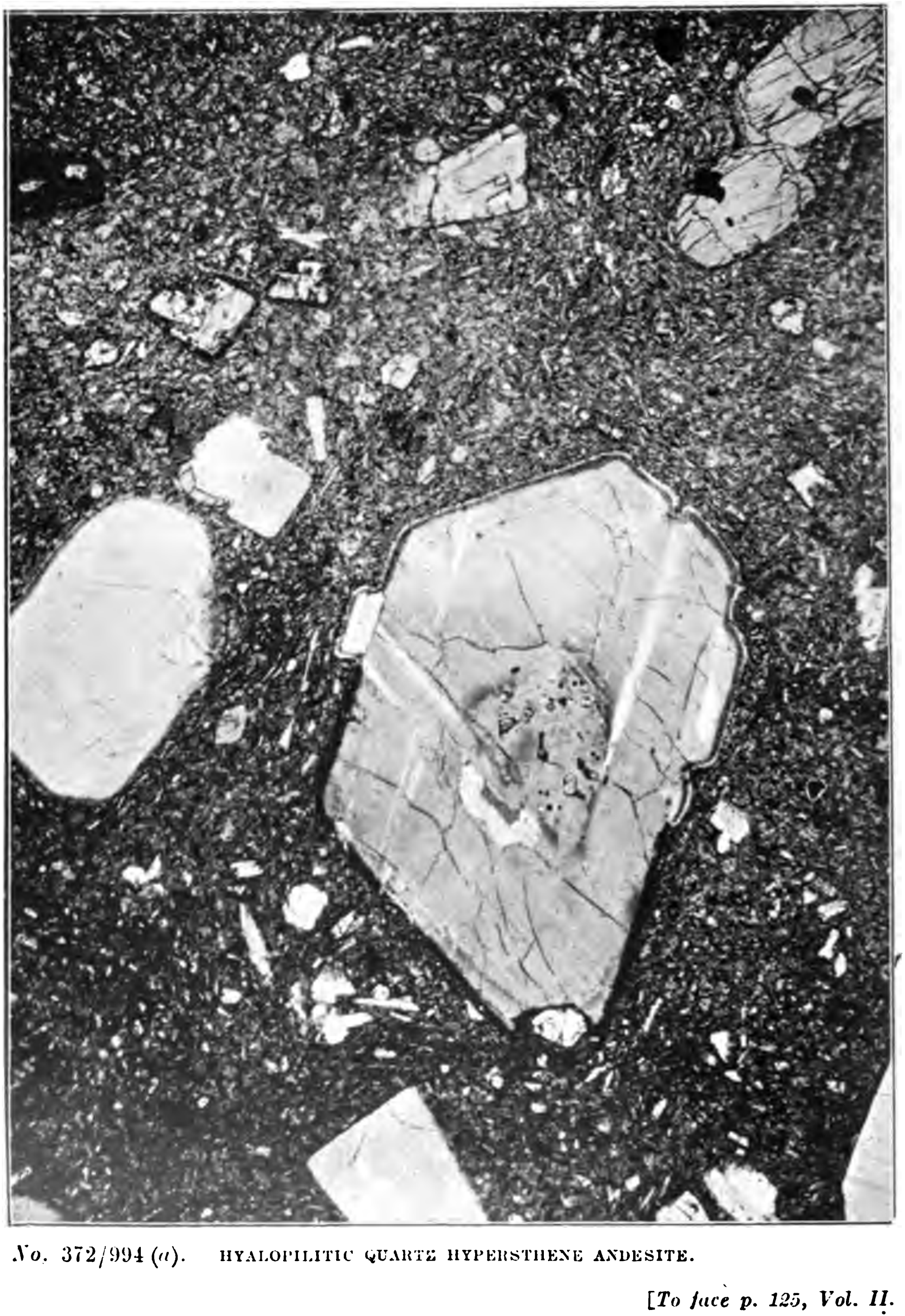
No. 371/991 (*a*). HYALOPILITIC QUARTZ HYPERSTHENE ANDESITE.

[To face p. 124, Vol. II.



No. 371/991 (*b*). HYALOPILITIC QUARTZ HYPERSTHENE ANDESITE.

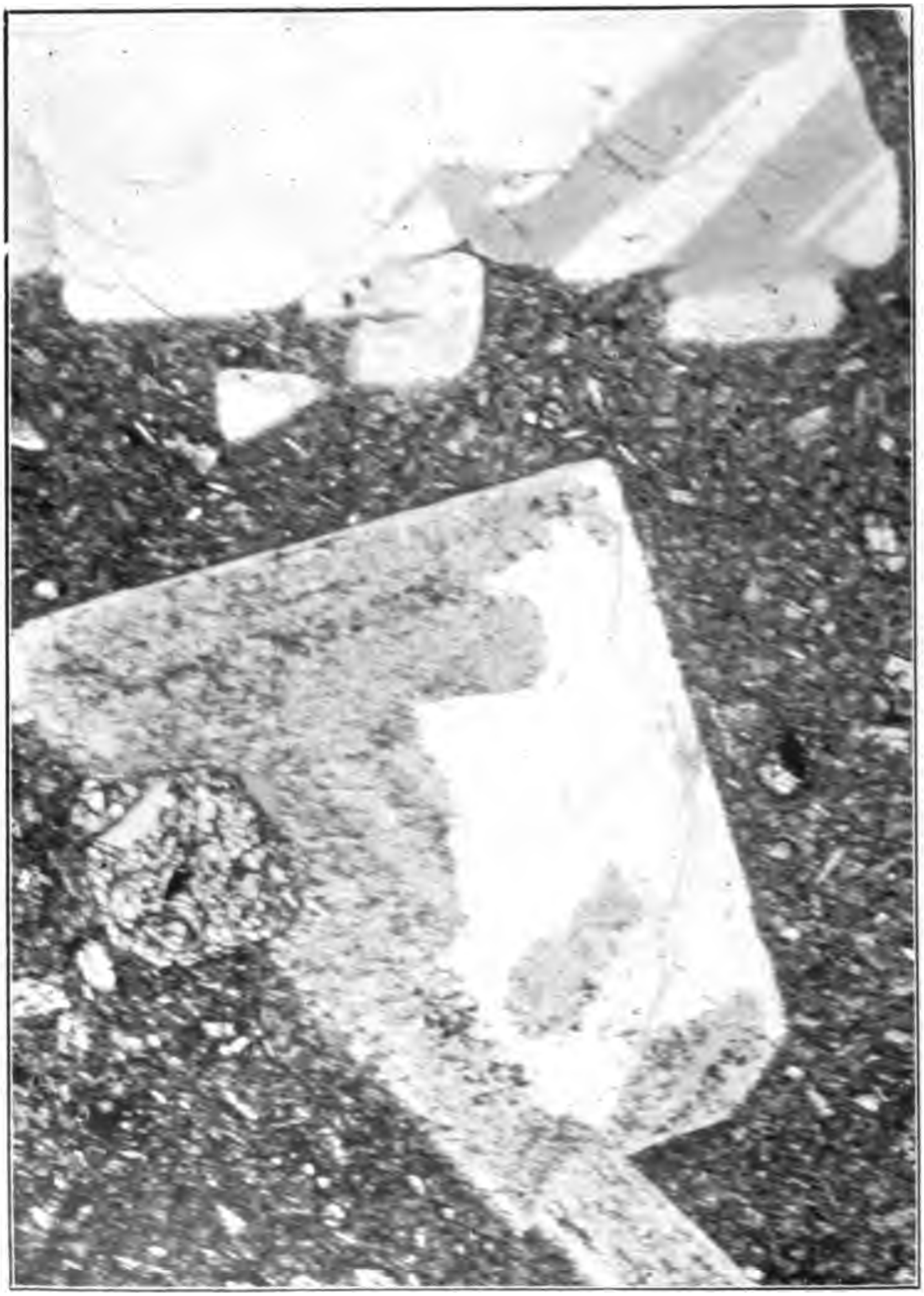
[*To face p. 124, Vol. II.*



No. 372/994 (*a*). HYALOPILITIC QUARTZ HYPERSTHENE ANDESITE.

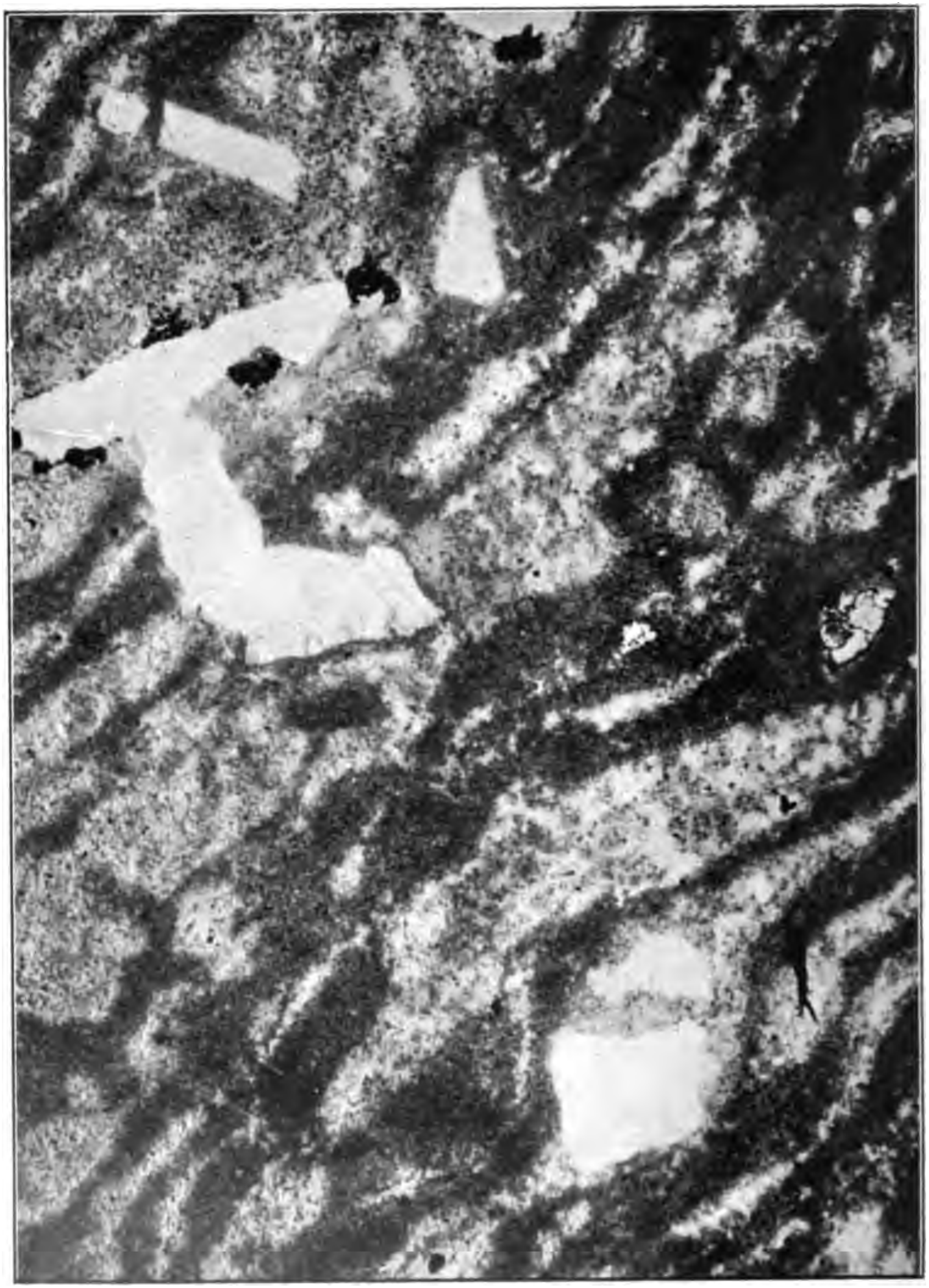
[*To face p. 125, Vol. II.*

i.



No. 372/994 (b). HYALOPILITIC QUARTZ HYPERSTHENE ANDESITE.

[To face p. 125, Vol. II.
ii.



No. 373/995. DACITE (?).

[*To face p. 125, Vol. II.*
iii.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; two negatives were taken, *a* 33 diameters, and *b* 66 diameters; areas photographed, lower middle and lower right, which are characteristic of the whole of the slice.

Locality.—West side of Table Mountain, Thames County

Formation and Remarks.—Same as for No. 991.

No. 373/995.

M.C.—Purple flow-rock, with fresh phenocrysts of felspar.

U.M.—MATRIX formed of alternating streaks of finer and coarser crystalline material; the finer is chiefly spherulitic, sometimes confusedly, sometimes more regularly, the spherulites are composed of evidently crystal rays of felspar with intervening *x* and have a negative optical sign; the coarser is composed of well-formed crystals of felspar, some of which have a *r.i.* lower than balsam, and crystals of *x*. The finer was probably formed first.

PHENOCRYSTS.—*Plagioclase:* A fair sprinkling of well-formed crystals variously twinned, fresh, with a *r.i.* usually above balsam (andesine).

Augite: A stray crystal or two.

Hypersthene: Not numerous crystals, but more so than augite; the usual pleochroism, often surrounded by a narrow halo of biotite. Small flakes of biotite also occur in the coarser parts of the matrix.

Magnetite: Fairly numerous grains, oxidized into red ferric hydrates at the margin, frequently associated with hypersthene. Hypersthene, plagioclase, and magnetite may occur together in a complex.

There are no rhyolitic quartz grains, though a little quartz may be present in some of the coarser parts of the matrix. Without a chemical analysis, or at least a silica determination, it is very difficult to say where such a rock should be placed. Judging from the phenocrysts it would be an **Andesite,** but since there is evidently much silica in the matrix it is more probably a **Dacite,** and may be a **Soda-rhyolite.**

Illustration.—Slice shows fair contrasts, yielding a good negative.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper left, which is characteristic of the whole slice.

Locality.—The source of Waiwawa Creek, a branch of the Kauaeranga, taking its rise from Table Mountain, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—The specimen was taken from a block forming part of a coarse agglomerate of rhyolitic rock that, in contact with the great dyke of Table Mountain, underlies pumiceous breccias of finer grain, these latter being in turn overlain by sedimentary beds with which bands of impure lignite are associated. The carbonaceous beds frequently preserve plant-remains, and at places are crowded with a species of fresh-water mollusc (*Unio*). These beds find almost their exact counterpart east of Table Mountain along the Rangihau Valley, east of the lower part of which the lower coarse agglomerate is well represented, while south of the upper part of the valley the upper and finer-grained beds are overlain by thick flows of solid rhyolite.

No. 374/1002.

M.C.—Purple and white rock, in flow-lines and phenocrysts of felspar.

U.M.—This rock is identical in all important details with the preceding, No. 995. The stream-lines are more wavy, and the coarser parts a little more coarsely crystallised with biotite, yellow / almost colourless, in large skeleton crystals; a single crystal of brown biotite with reaction border was observed in the finer matrix. Forked rectangles of felspar extending parallel are also present in the matrix; they do not appear to have had any influence on the disposition of the surrounding spherulites.

The colour of the rock depends on the abundant presence of fine granules of brown ferric hydrate, which are clustered together cumulitic fashion.

Dacite or **Soda-rhyolite** with flow-structure.

Locality.—Source of the Waiwawa River, west side of Table Mountain, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—This specimen, like No. 995, is from the pumiceous agglomerate broken through by the great dyke forming Table Mountain.

No. 375/1013.

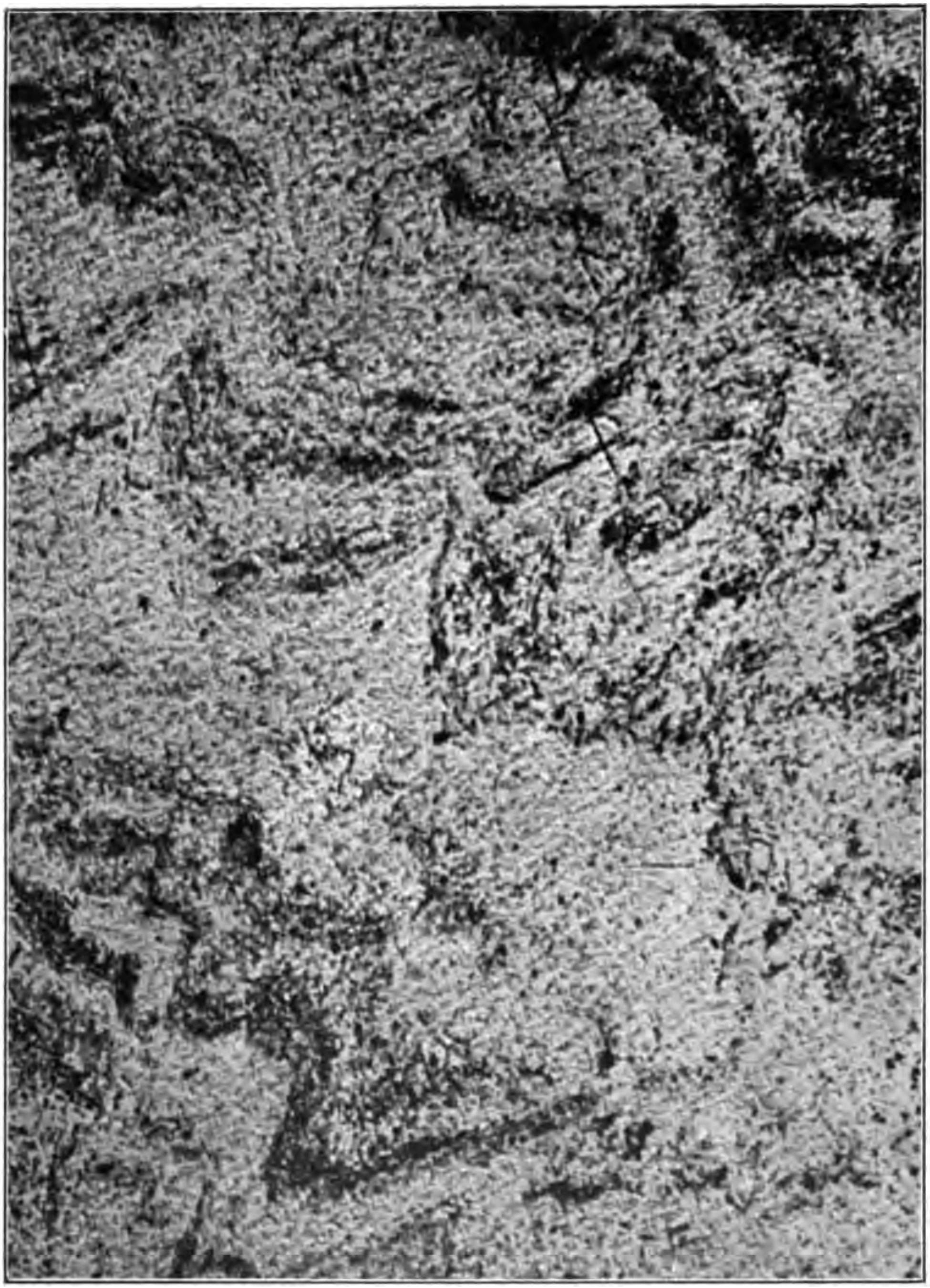
M.C.—Black obsidian, with rare phenocrysts of felspar and an occasional spherulite.

U.M.—Colourless glass, with wavy and contorted stream-lines indicated by belonites, which are densely crowded in some streaks, and rarer or absent in others. Trichites are also present, both simple and radiately clustered. Rectangles of felspar also occur, and micropegmatitic felspar growths, the rudiments of spherulites. Magnetite granules are also generally distributed. An occasional fragment of a plagioclase phenocryst may be observed.

Obsidian, with flow-structure and rare spherulites.

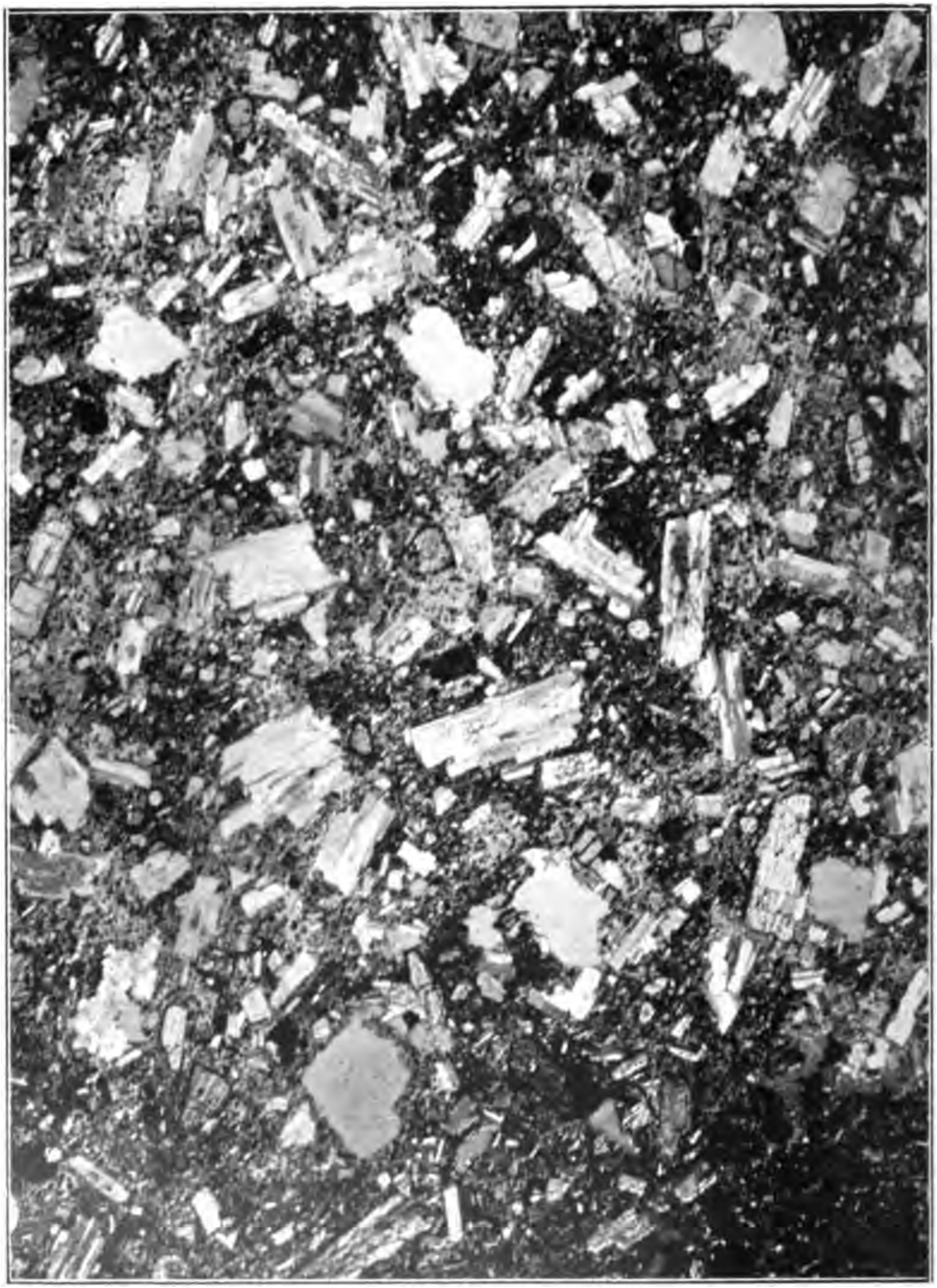
Illustration.—Slice shows fair contrasts.

Photographed by polarised light; magnification, 212 diameters; area photographed, middle right, where the contortions of the flow-lines are best seen.



No. 375/1013. OBSIDIAN WITH FLOW STRUCTURE.

[*To face p.* 126, *Vol. II.*



No. 376/1034. HYALOPILITIC HYPERSTHENE ANDESITE.

[*To face p. 127, Vol. II.*

Locality.—Pannikin Hill, on the east side of the Whitianga River, four miles from its mouth, Mercury Bay district.

Formation.—Acid group of Pliocene age.

Remarks.—This rock occurs as a dyke-like mass in the vicinity of the sinter-deposits of an extinct hot spring. The dyke-like extension of this rock, and its glassy character, led to the belief that it was a form of quartz and possibly auriferous, and as a consequence a considerable quantity of the rock was excavated; and it is also said that some gold was obtained during the process. This is not incredible, since a little gold is to be found in most of the pumiceous deposits from the Bay of Plenty to Lake Taupo.

No. 376/1034.

M.C.—Black compact rock, brownish in places, with small phenocrysts of felspar and pyroxene.

U.M.—MATRIX: Coloured glass crowded with minute prisms of felspar, and pyroxene and granules of magnetite, in stream-lines; in places the hyalopilitic is exchanged for the micropœcillitic structure.

PHENOCRYSTS.—*Plagioclase* predominant, well-formed crystals, irregular complexes, and irregular twinning; various inclusions, many crystals with a core of green chloritic material, others with a submarginal zone of negative crystals of glass; ext., 33°/ 34°.

Augite: Greyish-green to brownish-yellow, very faint, crystals fresh, not numerous.

Hypersthene: Fresh, usual pleochroism, more abundant than augite, with which it is not infrequently associated; sometimes the two pyroxenes are intergrown. In a few cases the hypersthene is converted into serpentine.

Magnetite: Only one or two large grains.

Hyalopilitic (in places micropœcillitic) **Hypersthene Andesite.**

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which is characteristic of the whole slice.

Locality.—The Quarries, near western base of Omahu Peak, Thames County.

Formation.—Beeson's Island group.

Remarks.—This rock is thin-bedded and rubbly, and, though much of it is scarcely fit for road-metal, the comparative ease with which it can be quarried compensates for the considerable amount that has to be rejected.

No. 377/1035.

M.C.—A flow-rock, with white and black banding, containing evident phenocrysts.

U.M.—MATRIX: Streaks of "microfelsite" yellowish-brown in colour, with numerous felspar laths in stream-lines; containing also leucoxene and small irregular quartz granules alternating irregular masses of micropœcillitic quartz, and occasional bands of clear quartz mosaic. Veins of quartz mosaic cross the banding transversely and become continuous with the bands, which run with the stream-lines. Pyrites occurs in this quartz, and radio-fibrous growths of a zeolite (?). On isolation this zeolite proves to have a *r.i.* close upon 1·486 (considerably below 1·496 and scarcely above 1·486); it extinguishes parallel, and its optic sign in relation to the elongation is always —. Hydrochloric acid has little effect upon it. These characters are not found in any species known to me; stilbite approaches nearest, but has a higher *r.i.* and obl. extinction.

Some of the "microfelsite" is stained yellow by iron-ochre.

PHENOCRYSTS.—*Plagioclase:* A fair sprinkling of well-formed crystals, some broken in places; *r.i.* above balsam.

Pyroxene: Replaced by quartz in mosaics; not common.

Ilmenite: Converted into leucoxene, several plates.

Magnetite: In association with apatite; often bordered by pyrites.

Apatite: Some fairly large crystals, often included in plagioclase.

It is impossible to name these rocks with excess of groundmass, especially after the secondary introduction of quartz, as in this case. I should think it is either a **Dacite** or a **Soda-rhyolite.**

Illustration.—Slice shows fair contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower right, which is characteristic of the greater part of the slice.

Locality.—Rangihau Valley, at the junction of Slip Creek with the Rangihau, Gumtown district.

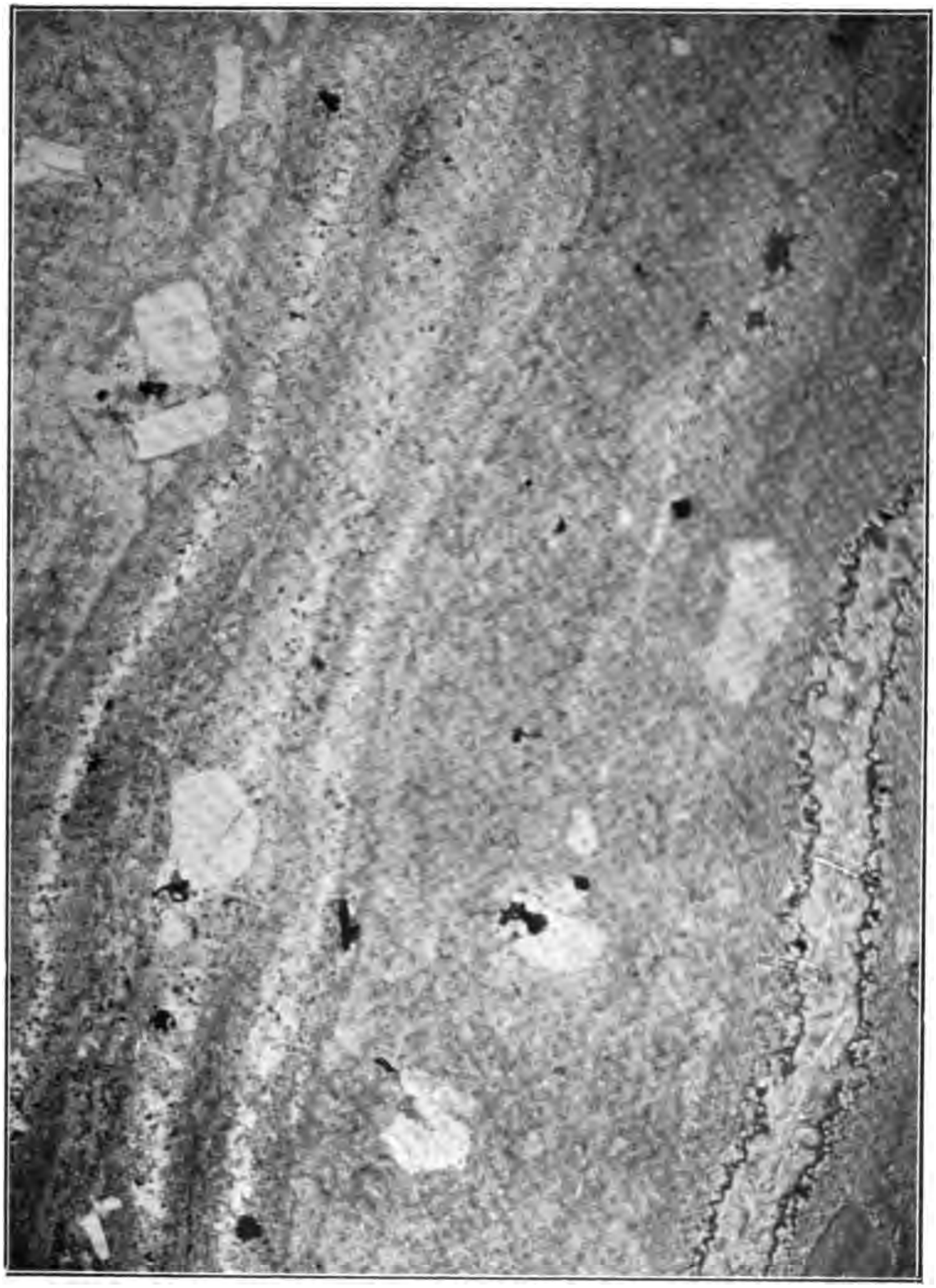
Formation.—Acid group of Pliocene age.

Remarks.—The etching does not show as clearly as might be expected the distinction between the different bands of material. The specimen was collected partly on account of the great quantity of magnetite present in some of the layers, but more particularly on account of a very fine example of zeolite which it contained. This evidently got displaced and lost, but from the description of the slice it would appear that other zeolites, if of less size, were present in the rock.

No. 378/1038.

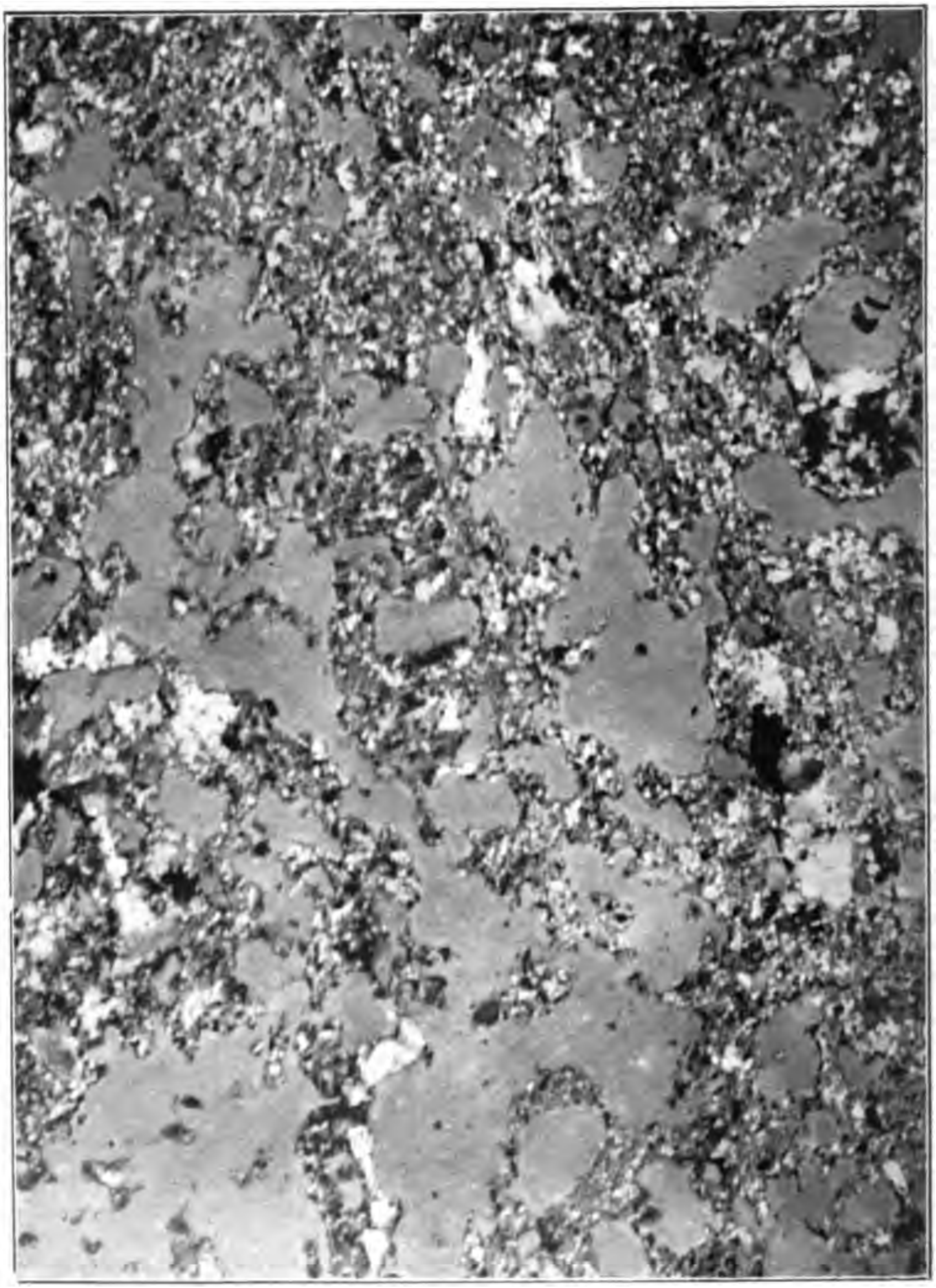
M.C.—A white, strong rock, with evident quartz, and angular cavities.

U.M.—A network of fine quartz mosaic, enclosing numerous irregular cavities and including large rhyolitic quartz grains. The quartz mosaic is



No. 377/1035. DACITE OR SODA RHYOLITE.

[*To face p. 128, Vol. II.*



No. 378/1038. ALTERED SPHERULITIC RHYOLITE.

[To face p. 129, Vol. II.

i.

Formation.—Beeson's Island group.
Remarks.—This is a very fine-grained rock, and might possibly be mistaken for compact slate, slate having been reported as present at Waihi Beach.

No. 380/1040.

M.C.—Greyish-green compact rock, with phenocrysts of plagioclase and ferromagnesian minerals.

U.M.—Matrix : Micropœcillitic, with abundant felspar microliths in streamlines, chlorite scales, leucoxene and magnetite grains. Matrix constitutes two-thirds of the rock.

Phenocrysts.—*Plagioclase:* Crystals not numerous, partly replaced by carbonates and chlorite, cracked and injected with quartz or a second felspar; *r.i.*, above balsam; ext., 12°/ 15° (oligoclase–andesine). Poor in primary inclusions.

Pyroxene: Crystals not numerous, small, represented by pseudomorphs in chlorite and carbonates; there seem to be two species of chlorite, pennine and clinochlore, and these may correspond to augite and hypersthene.

Hornblende: Numerous resorption pseudomorphs, sometimes of large size.

Magnetite: A few grains with associated apatite, also ilmenite, largely converted into sphene and leucoxene.

Micropœcillitic Hornblende Andesit (somewhat altered).

Locality.—Creek joining the Mahakirau at Hooker's, Coromandel - Mercury Bay Road, Coromandel County.
Formation.—Beeson's Island group.
Remarks.—This rock occurs in sheets interbedded with shales and sandstones containing thin seams of coal, evidently the lower part of the Beeson's Island group. The shales and sandstones are at no great distance west of the boundary of the Thames-Tokatea rocks.

No. 381/1041.

M.C. — Light-greenish-grey compact rock, with phenocrysts of felspar and scattered pyrites.

U.M.—Matrix : Chlorite scales, quartz grains, and dendritic leucoxene; becoming in places a quartz mosaic, with chlorite scales between the quartz grains. Pyrites scattered.

Phenocrysts. — *Plagioclase:* Not many large crystals, and these much broken internally, replaced by chlorite and kaolin, and invaded by quartz. Synthetic twinning still survives, but only faintly visible.

Pyroxene or *Hornblende :* Patches of chlorite containing leucoxene represent one or other, or both, of these minerals, but since the crystalline outlines have disappeared it is impossible to say more.

A Much-altered Andesite (?).

Locality.—Creek joining the Mahakirau at Hooker's, Coromandel - Mercury Bay Road, Coromandel County.

Formation.—Beeson's Island group.

Remarks.—The same as for the preceding specimen, No. 1040.

No. 382/1042.

M.C. — Reddish-brown compact porphyritic rock, with fairly large felspar and hornblende.

U.M. — MATRIX : A colourless glass containing felspar (plagioclase) laths and thin tabular plates in stream-lines, hypersthene prisms, augite, resorption pseudomorphs after hornblende, and magnetite grains. Small irregular vesicles occur filled with granular chlorite. Matrix about half the rock.

PHENOCRYSTS. — *Plagioclase :* Fairly numerous crystals, some highly zonal, some not; variously twinned ; *r.i.*, above balsam ; ext. 16°/ 17° (andesine).

Augite : Rather numerous, somewhat small, faint-greenish-coloured crystals, with in many cases a thin black reaction border.

Hypersthene : Fresh crystals, fairly numerous, sometimes intergrown with augite, sometimes surrounded by a marginal border of augite. The usual pleochroism, and frequently bounded by a narrow reaction border, some replaced by reaction products.

Magnetite and *ilmenite* well represented. One large plate of ilmenite largely converted into leucoxene.

Hornblende : Ferriferous. Numerous resorption pseudomorphs ; some are of large size, and include pyroxene. A core of hornblende survives in some cases ; its pleochroism is marked, straw-yellow / red-brown ; ext., 0°.

Hornblende Hypersthene Andesite.

Locality.—Mercury Bay - Coromandel Road, one mile east of Hooker's, Mahakirau Valley, Coromandel County.

Formation.—Beeson's Island group.

Remarks.—Occurs on the roadside immediately on crossing bridge on road to Mercury Bay.

No. 383/1046.

M.C.—Black compact rock, with numerous phenocrysts of felspar.

U.M.—Matrix: Colourless glass, with abundant felspar laths and rectangles in stream-lines, some pyroxene, and numerous magnetite grains. Micropœcillitic grains scattered sporadically.

Phenocrysts. — *Plagioclase:* Large crystals and complexes, variously twinned; *r.i.*, above balsam; ext., 5°/ 5°, 14°/ 16° (oligoclase–andesine), zonal. Inclusions submarginal; sometimes general, filling the whole crystal except for a thin clear marginal zone. Inclusions consist of glass and alteration products, and some apatite.

Augite: Numerous, fresh, generally small, faintly-green crystals.

Hypersthene: Numerous, fresh, small and large crystals, usual pleochroism, but faint; include magnetite. The pyroxene frequently in clusters.

Hornblende: A few resorption pseudomorphs of unusual character, consisting of augite, plagioclase, magnetite, and apatite.

Magnetite: A fair number of grains.

Apatite: One crystal in hornblende pseudomorph, with black rods included, regularly arranged, parallel to *c* and to the sides of the hexagonal section.

Hyalopilitic (partly micropœcillitic) **Hypersthene Andesite.**

Illustration.—Slice in different parts shows good contrasts.

Photographed by polarised light; magnification, 66 diameters; area photographed, the middle part, within which the large phenocryst represented in the reproduction lies, and thus the middle part cannot be regarded as representative of the whole slice.

Locality.—Near Waitekauri Township, Ohinemuri County.

Formation.—Kapanga group.

Remarks.—Taken from a heap of road-metal half a mile south of the township.

No. 384/1071.

M.C.—Greyish-white spherulitic rhyolite, with obvious quartz phenocrysts.

U.M.—Matrix composed of positive spherulites, a few radial trichites.

Phenocrysts. — *Orthoclase,* undergoing change into granular isotropic material.

Quartz: Numerous large grains.

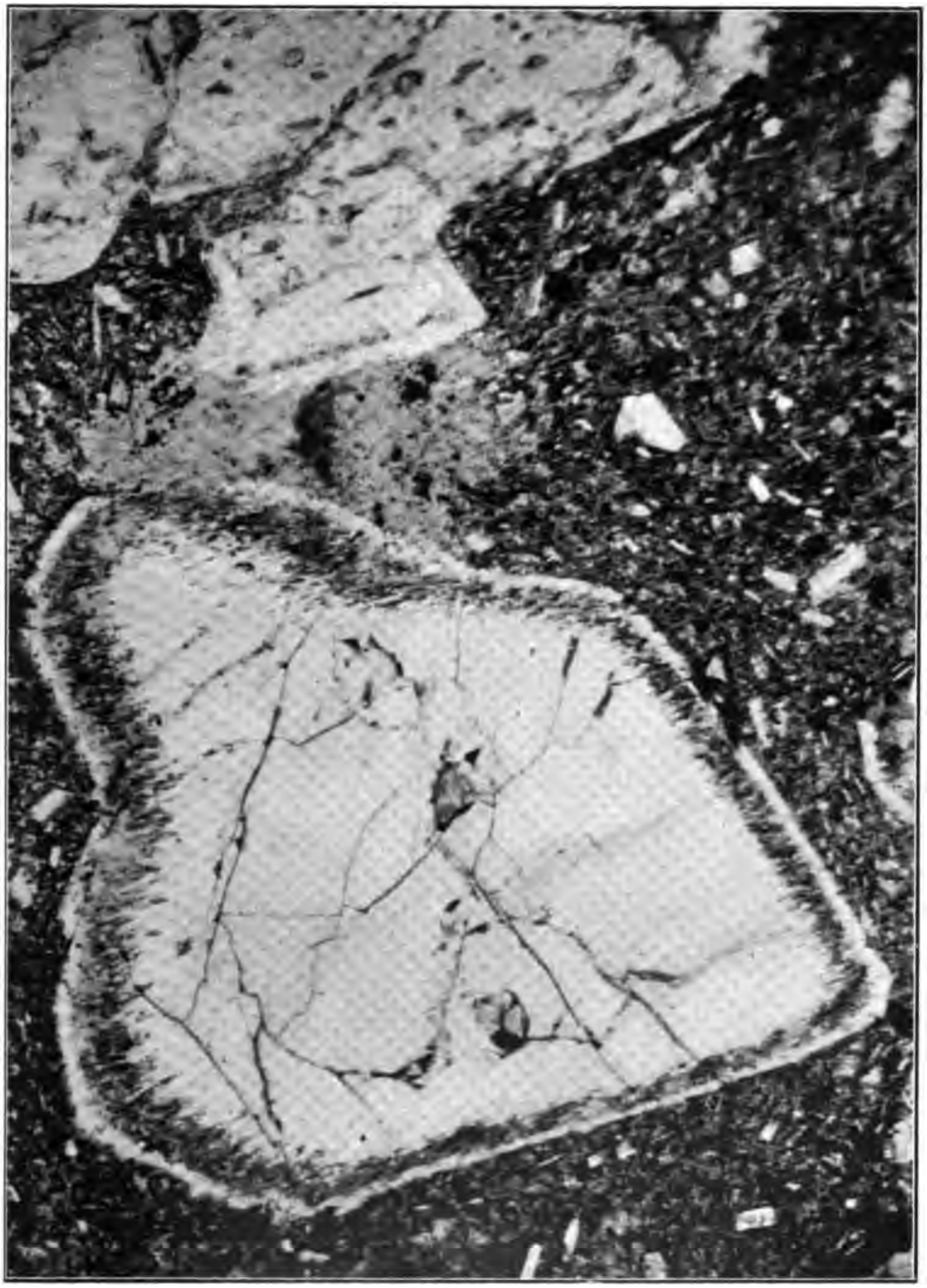
Biotite: A few crystals, undergoing decomposition.

Spherulitic Rhyolite.

Illustration.—Slice shows good contrasts.

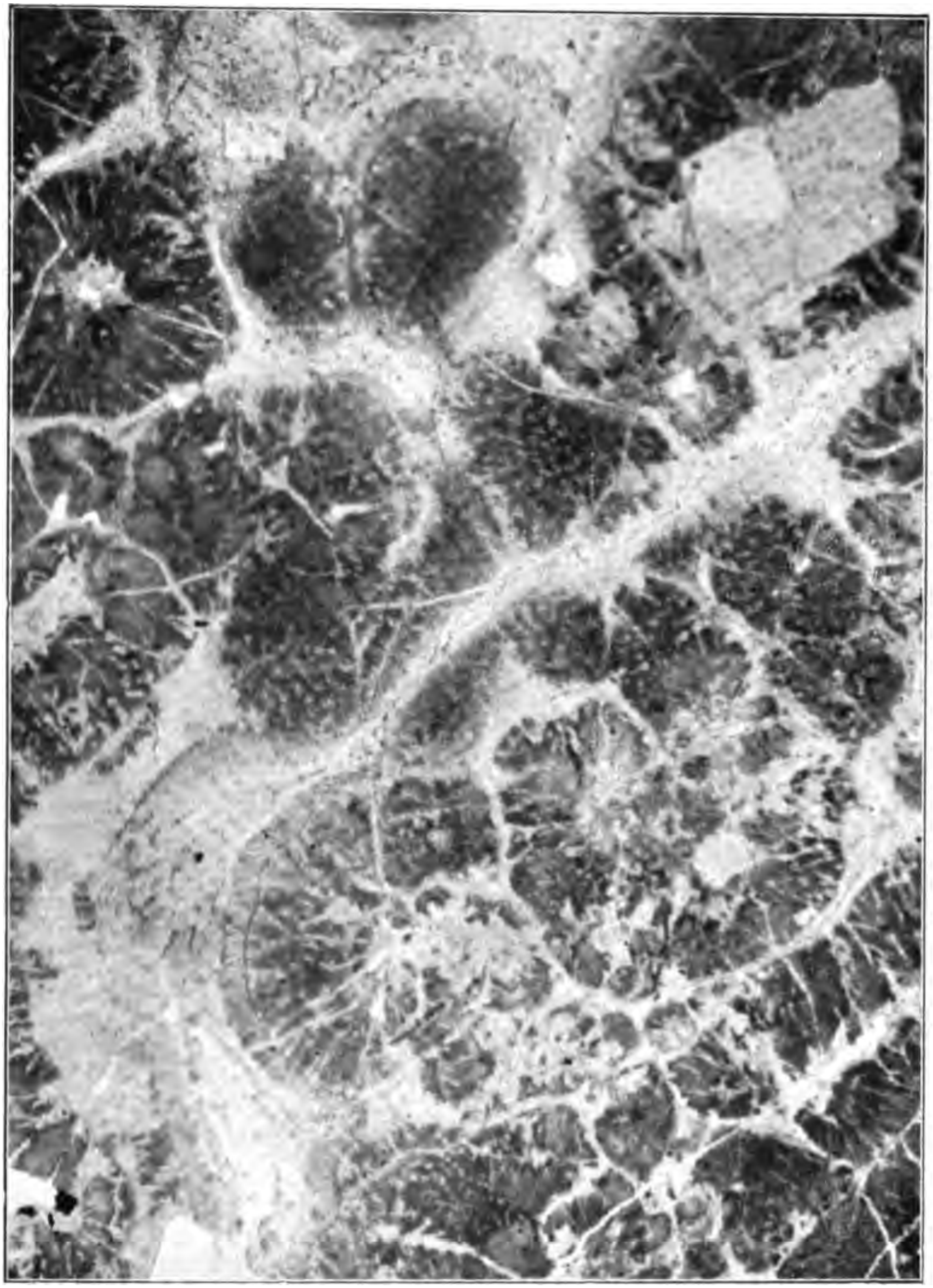
Photographed by polarised light; magnification, 33 diameters; area photographed, upper right, which is characteristic of the other parts of the slice.

Locality.—Hikurangi Mountain, Tauranga County.



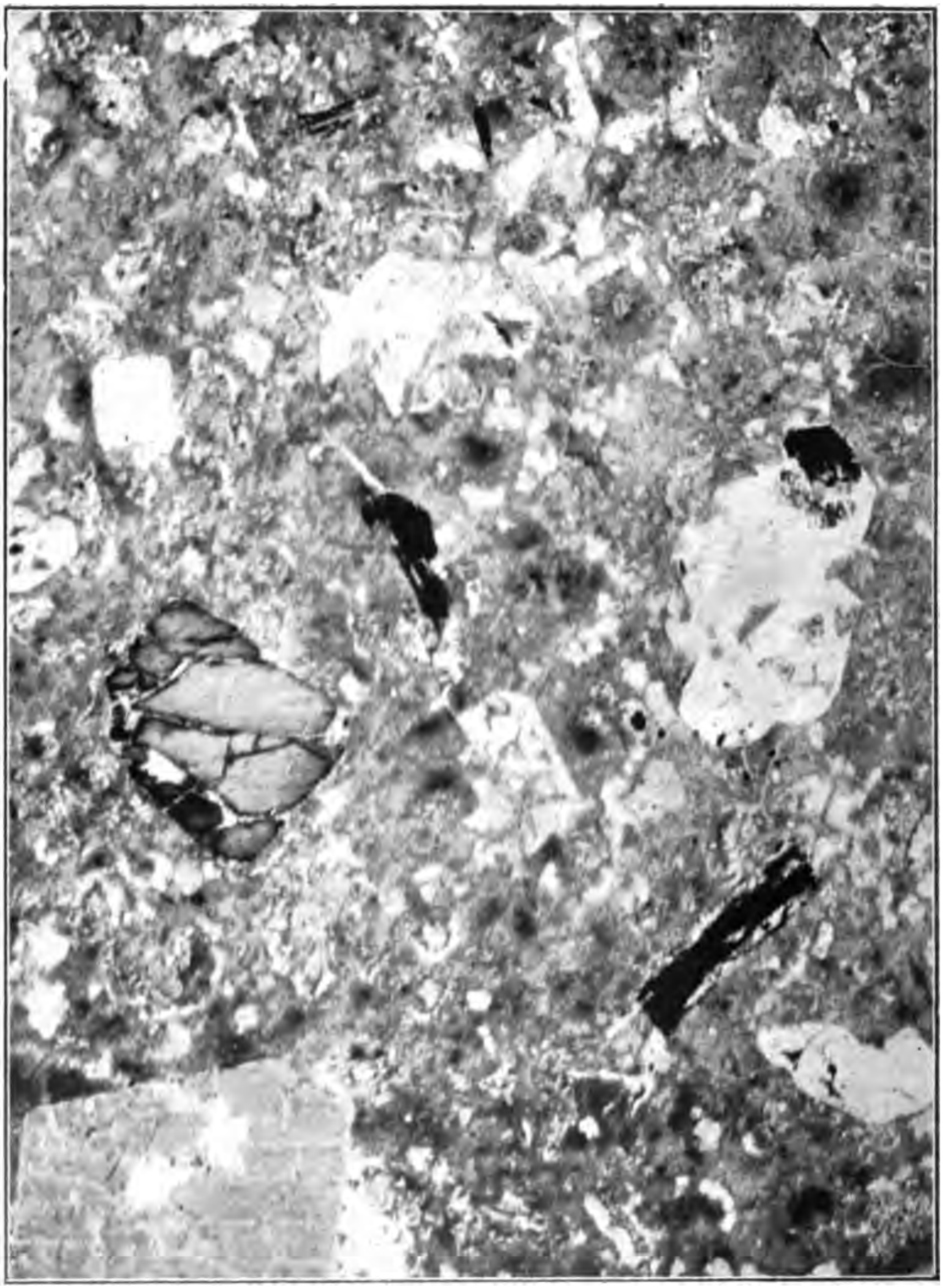
No. 383/1046. HYALOPILITIC HYPERSTHENE ANDESITE.

[*To face p.* 132, *Vol. II.*
i.



***No.* 384/1071.** SPHERULITIC RHYOLITE.

[*To face p. 132, Vol. II.*
ii.



No. 385/1072. SPHERULITIC RHYOLITE.

[*To face p. 133, Vol. II.*

Formation.—Acid group of Pliocene age.

Remarks.—The specimen is from the east spur of the mountain, and from one of many large blocks of rhyolite that strew the lower slopes near the road-line.

Hikurangi is a volcanic mountain that still retains the outlines of a crater, the last eruption from which broke down the crater-wall on the north side.

No. 385/1072.

M.C.—White, decomposed, friable rhyolite, with quartz, biotite, and felspar phenocrysts.

U.M.—MATRIX composed of small positive spherulites, partly decomposed, partly replaced by quartz. In the interspaces accumulations of *x*.

PHENOCRYSTS.—*Felspar :* Decomposed into isotropic granular material, but fresh crystals are present, and have the characters of orthoclase.

Quartz in numerous grains.

Biotite : A few decomposed crystals.

Spherulitic Rhyolite, partly replaced by quartz.

Illustration.—Slice shows fair contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle right, which is characteristic of the other parts of the slice.

Locality.—Hikurangi Mountain, Tauranga County.

Formation.—Acid group of Pliocene age.

Remarks.—This is a different rock from the preceding (No. 1071), and, collected from the southern base of the mountain, was taken on account of its resemblance to the intrusive rhyolites of the Upper Hikutaia Valley.

No. 386/1075.

M.C.—Banded flow-rock, greyish-black streaked with white, compact, stony, with small phenocrysts of felspar and ferro-magnesian mineral.

U.M.—MATRIX: Colourless glass crowded with plagioclase laths and rectangles, pyroxene prisms, and magnetite grains in stream-lines. Numerous crystals of *x* present. The matrix forms the greater part of the rock.

PHENOCRYSTS.—*Plagioclase :* Not very numerous crystals and fragments; *r.i.*, above balsam; ext., 20°/20° (andesine). Some large glass inclusions.

Augite : A few small crystals, greenish in tint; ext., 39°.

Hypersthene : A few fresh crystals, usual pleochroism.

Hornblende : One or two resorption pseudomorphs.

Magnetite : A few large grains.

Hyalopilitic Hypersthene Andesite, with hornblende.

Locality.—Long cutting descending into valley of Waiau Creek, Waihi-Tauranga Road.

Formation.—Beeson's Island group.

Remarks.—This rock shows flow-structure on a scale perhaps too great to be indicated in the slice, but which is well seen in the hand-specimen, which was taken purposely large in order to show this character.

No. 386A/1078.

M.C.—Grey banded rhyolite, with mica.

U.M.—MATRIX: Banded in undulating stream-lines; negative microspherulitic structure is prevalent; brown (white by reflected light), granular, irregularly branching microfelsite spherulites occur with margins of negative microspherulitic material. Irregular quartz mosaics with micropœcillitic structure include small clear positive spherulites. Trichites and stellate crystallites are generally disseminated, and particularly abundant in the clear micropœcillitic areas.

PHENOCRYSTS.—*Orthoclase* (sanadine) in small crystals.

Plagioclase is somewhat commoner than orthoclase, in small crystals and fragments, sometimes zonal; *r.i.*, not far different from balsam; ext., low (oligoclase–andesine).

Biotite: A few fresh sometimes-corroded crystals, straw-yellow / black.

Quartz: Numerous corroded grains and bi-pyramids.

Rhyolite, containing plagioclase.

Locality.—Hikutaia River bed, Thames County.

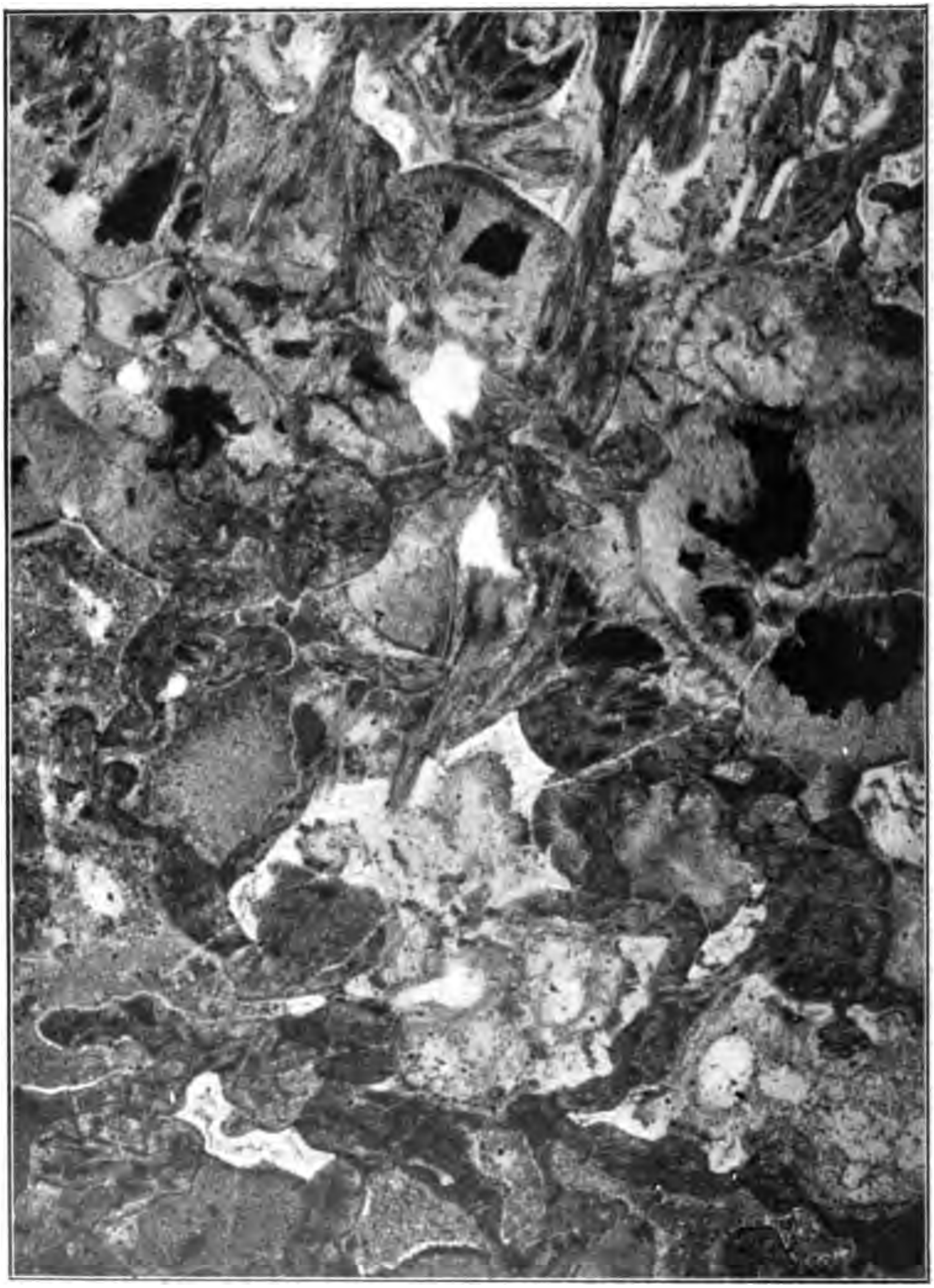
Formation.—Acid group of Pliocene age.

Remarks.—At the locality of the specimen three-fourths of the shingle of the river-bed is rhyolitic.

No. 387/1131.

M.C.—Banded spherulitic rhyolite.

U.M.—MATRIX banded in stream-lines, some bands with trichites in stream-lines. The flow-structure was evidently disturbed by subsequent events; it is interrupted by transverse lines, along which microspherulites are well developed, and which continue into nests of the mineral we have designated *x*. Some of the transverse cracks are sharply defined, and filled with a yellow doubly refracting substance; the course of the trichites is disturbed on each



No. 387/1131. SPHERULITIC RHYOLITE.

[To face p. 135, Vol. II.

side of the cracks. Large positive spherulites are present, and determine the curvature of some of the flow-lines; they were evidently formed before the rock had completely lost its fluidity. These spherulites are broken irregularly, and resulting cavities are lined with *x*. They include similar but smaller spherulites, are impregnated with quartz, and sometimes mosaicised. The radiate growth of their fibres seems sometimes to commence from the surface of an internal fracture.

PHENOCRYSTS.—*Plagioclase:* A few much-cracked crystals, largely worn away in the preparation of the slice.

Ferro-magnesian minerals represented by a few pseudomorphs in colourless serpentinous matter.

Quartz grains absent.

Spherulitic Rhyolite.

Illustration.—Slice shows fair contrasts.

Photographed by ordinary light; magnification, 33 diameters; area photographed, middle part, which, owing to a variability in the slice, is scarcely characteristic of the whole.

Locality.—Hikutaia River bed, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—This specimen probably reached the river-bed from the north side of the valley, rhyolite of a similar sort crowning the range further to the west than on any other spur outrunning from the main range.

No. 388/1139.

M.C.—Compact grey rhyolite, with mica.

U.M.—MATRIX composed of negative microspherulites, of different size in different bands; interstitial *x* occurs between them sometimes defining the outline of a microspherulite.

PHENOCRYSTS.—*Sanadine* in clear rounded crystals, sometimes twinned.

Plagioclase in crystals and fragments, *r.i.* about the same as balsam, some with a core of altered glass.

Biotite: A few brownish-yellow / greenish-brown crystals.

Quartz: Numerous corroded grains and bi-pyramids.

Microspherulitic Rhyolite.

Locality.—Hikutaia Valley, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—The same as for No. 1131.

No. 389/1149.

M.C.—Perlitic pitchstone.

U.M.—Matrix colourless perlitic glass, with abundant trichites and stillate crystallites in stream-lines, trichites sometimes contorted, sometimes in radiate brushes. The glass is altered along the perlitic cracks. Small positive spherulites occur rarely.

Phenocrysts.—*Quartz* in corroded bi-pyramids abundant; some are traversed by perlitic cracks; a perlitic crack may be traced from the glass into the quartz, the same crack traversing both.

Plagioclase: Well-formed crystals, often cavernous within; *r.i.*, above balsam; ext., 18° (andesine); include augite and glass.

Biotite: A few fresh crystals, straw-yellow / green-black.

Rhyolitic Glass, containing plagioclase.

Illustration.—Slice shows but moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower right, which is characteristic of the rest of the slice.

Locality.—Hikutaia Valley, Thames County.

Formation.—Acid group of Pliocene age.

Remarks.—The same as for No. 1131.

No. 390.

No specimen.

No. 391/1170.

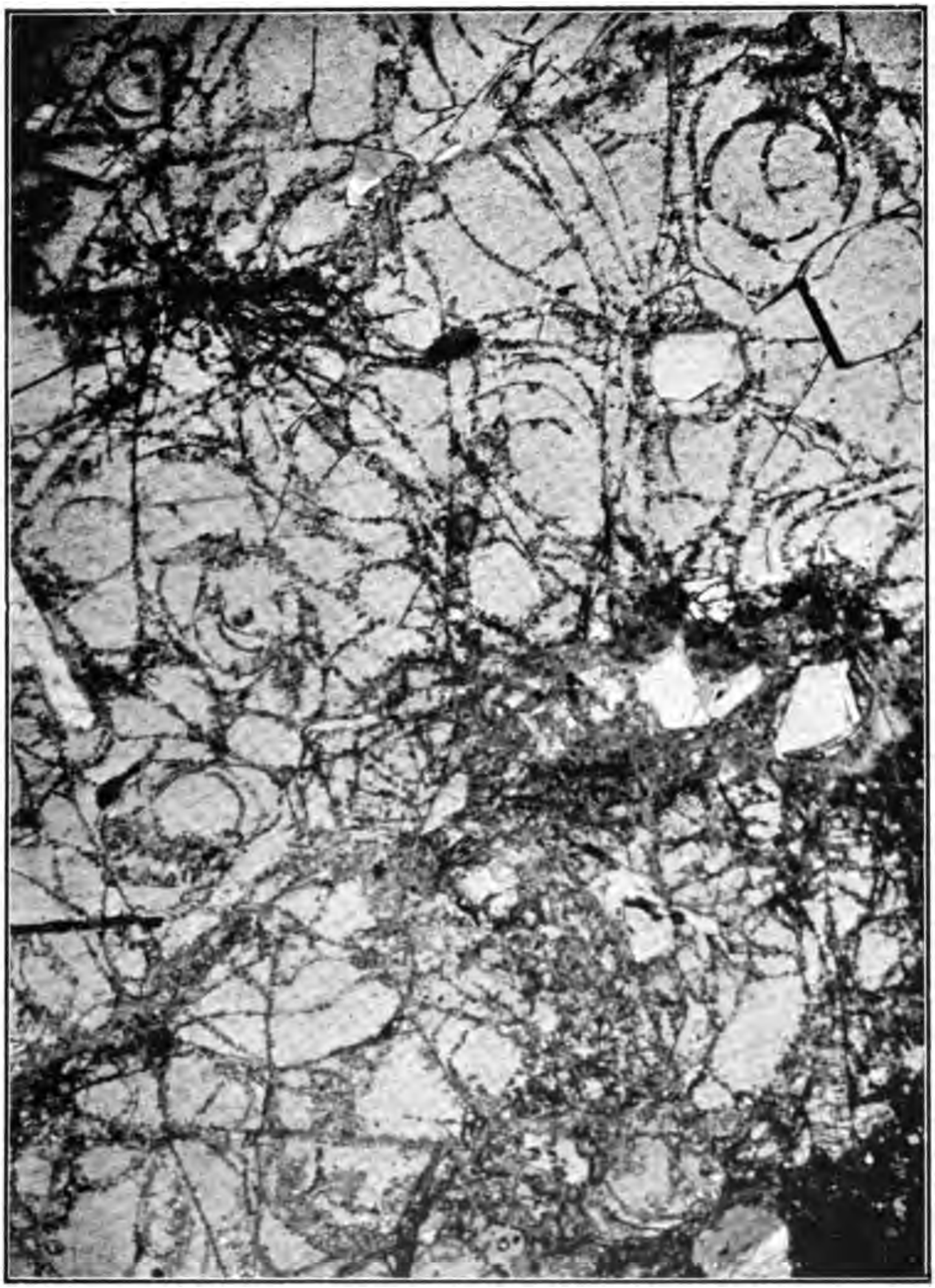
M.C.—Mottled-violet and yellowish-grey rock, with large phenocrysts of felspar and quartz.

U.M.—Matrix formed of so-called "microfelsite," blotched by quartz replacement; the "microfelsite" shows obscure negative microspherulitic structure, and contains belonites and other crystallites, magnetite granules, and occasional felspar laths. Pseudomorphs after pyroxene, biotite, and hornblende occur in the matrix.

Phenocrysts.—*Plagioclase:* A few large and small crystals, broken and invaded by the quartzose matrix; *r.i.*, above balsam; ext., 13°/ 16° (andesine); some zonal, often in fragments.

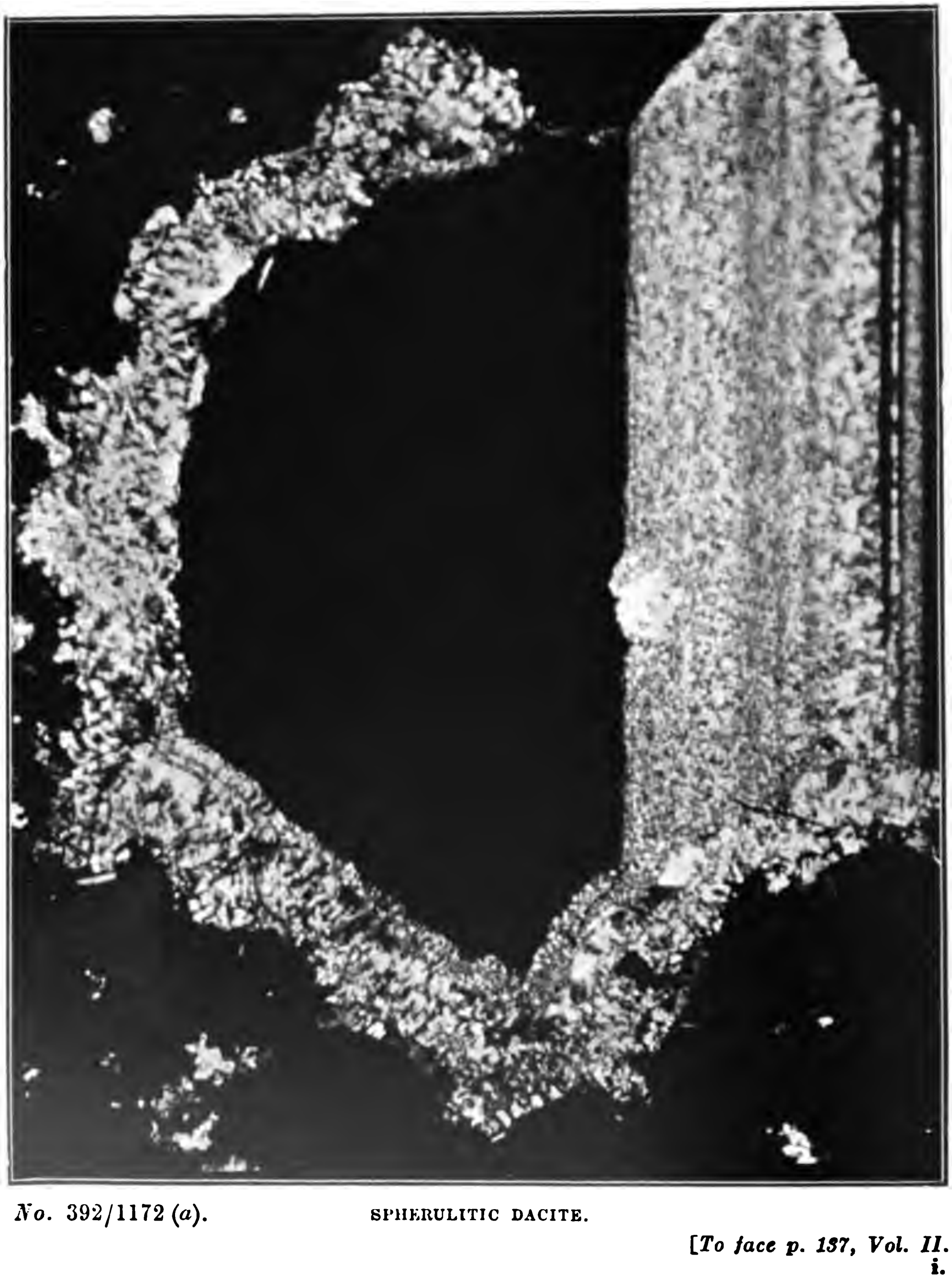
Augite and *hypersthene* represented by pseudomorphs of small crystals in green and greenish-yellow serpentine; from the form it would appear that the chief pyroxene was hypersthene.

Hornblende: Resorption pseudomorphs not uncommon, some still retaining a core of unaltered hornblende, yellow / green.



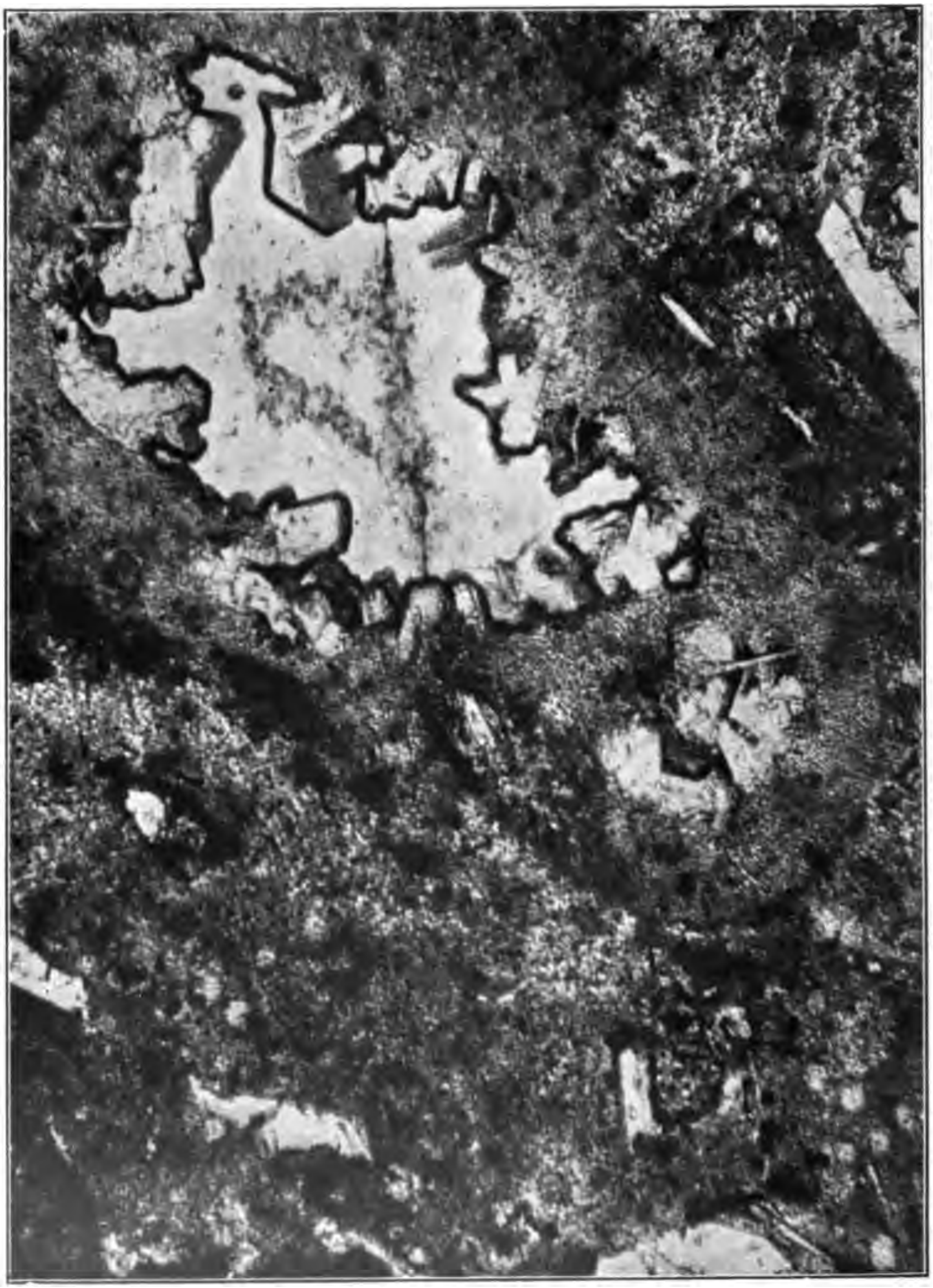
No. 389/1149. RHYOLITIC GLASS.

[*To face p. 136, Vol. II.*



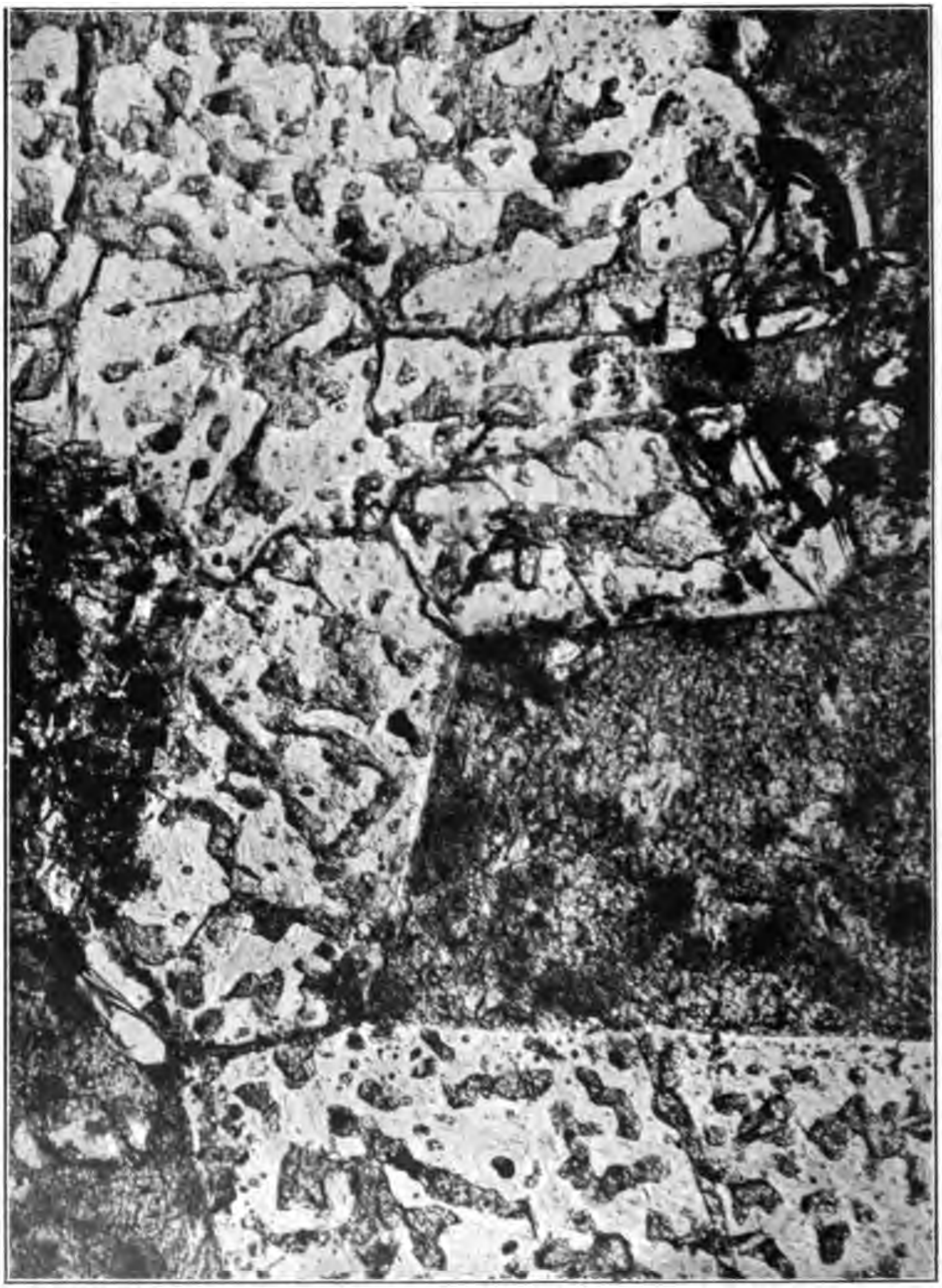
No. 392/1172 (*a*). SPHERULITIC DACITE.

[*To face p. 137, Vol. II.*
i.



No. 392/1172 (*b*). SPHERULITIC DACITE.

[*To face p. 137, Vol. II.*
ii.



No. 392/1172 (c). SPHERULITIC DACITE.

[To face p. 137, Vol. II.
iii.

Magnetite: Fairly numerous grains.
Quartz: Numerous large corroded grains.

Pyroxene Hornblende Dacite.

Locality.—Southern side of Ohinemuri Valley, half a mile below Owharoa.
Formation.—Kapanga group.
Remarks.—This rock lies in the line of the development of Beeson's Island rocks that form the Rahu Saddle, and some distance to the eastward stretches across the Ohinemuri Valley into that of the Waitawheta River.

No. 392/1172.

M.C.—Hornstone-like rock, with phenocrysts of felspar, and cavities lined by chalcedony and filled with opal.

U.M.—MATRIX usual brown, positive, spherulitic growths, often with a felspar phenocryst for nucleus, and colourless and more diffuse spherulitic growths. Some negative microspherulites are also present. Cavities of irregular form, from the walls of which numerous crystals of felspar project; these are coated with an envelope of brown isotropic material having a fibrous structure, the fibres being disposed with their length at right angles to the surface on which they are seated; the felspar and fibrous envelope may completely fill some of the smaller cavities, but in the larger a layer of mammillary chalcedony follows, and this may be succeeded by horizontal sheets of opal and chalcedony alternately.

Some of the cavities are lined by quartz crystals.

Belonites, trichites, and occasional felspar laths run in stream-lines.

PHENOCRYSTS.—*Plagioclase:* A fair sprinkling of crystals and fragments, with coarse irregular glass cavities; *r.i.*, above balsam; ext., 14°/ 16° (andesine). Some small crystals partly replaced by opal.

Pyroxene: Numerous small crystals as pseudomorphs in brown fibrous isotropic material, or opal. Apatite is sometimes seen in these.

Hornblende: Several crystals replaced by opal; in some a core still survives; straw-yellow / green. A little biotite.

Quartz: Several large corroded grains.

Magnetite: Often converted into leucoxene.

A Spherulitic Dacite, or Dacite Rhyolite.

Illustrations.—Slice shows good contrasts.

Photographed by polarised light. (*a.*) Magnification, 33 diameters; area photographed, upper left, showing the cavity filled with various minerals as per description above. (*b.*) Magnification, 120 diameters; area photographed, middle part.

Locality.— Ruapehu Claim, on the hills south-west of Owharoa, on the slope to the Waitawheta River, Ohinemuri County.

Formation.— Kapanga group.

Remarks.—This is a duplicate of specimen numbered 1, remarkable for the amount of water contained in cavities in the stone.

No. 393/1286.

M.C.—Greyish rock, with abundant black, flat, flake-like fragments lying in it in general parallelism.

U.M.—The slice shows tuff-like fragments of brown, ultra-microscopically granular glass, lapilli of pumice, fragments of plagioclase (*r.i.*, above balsam) and of quartz, biotite, pseudomorphs after pyroxene, and bits of positive spherulite, and the groundmass of volcanic rocks; with a roughly layered arrangement; all interstices being filled with a yellowish or green, granular or scaly, isotropic material.

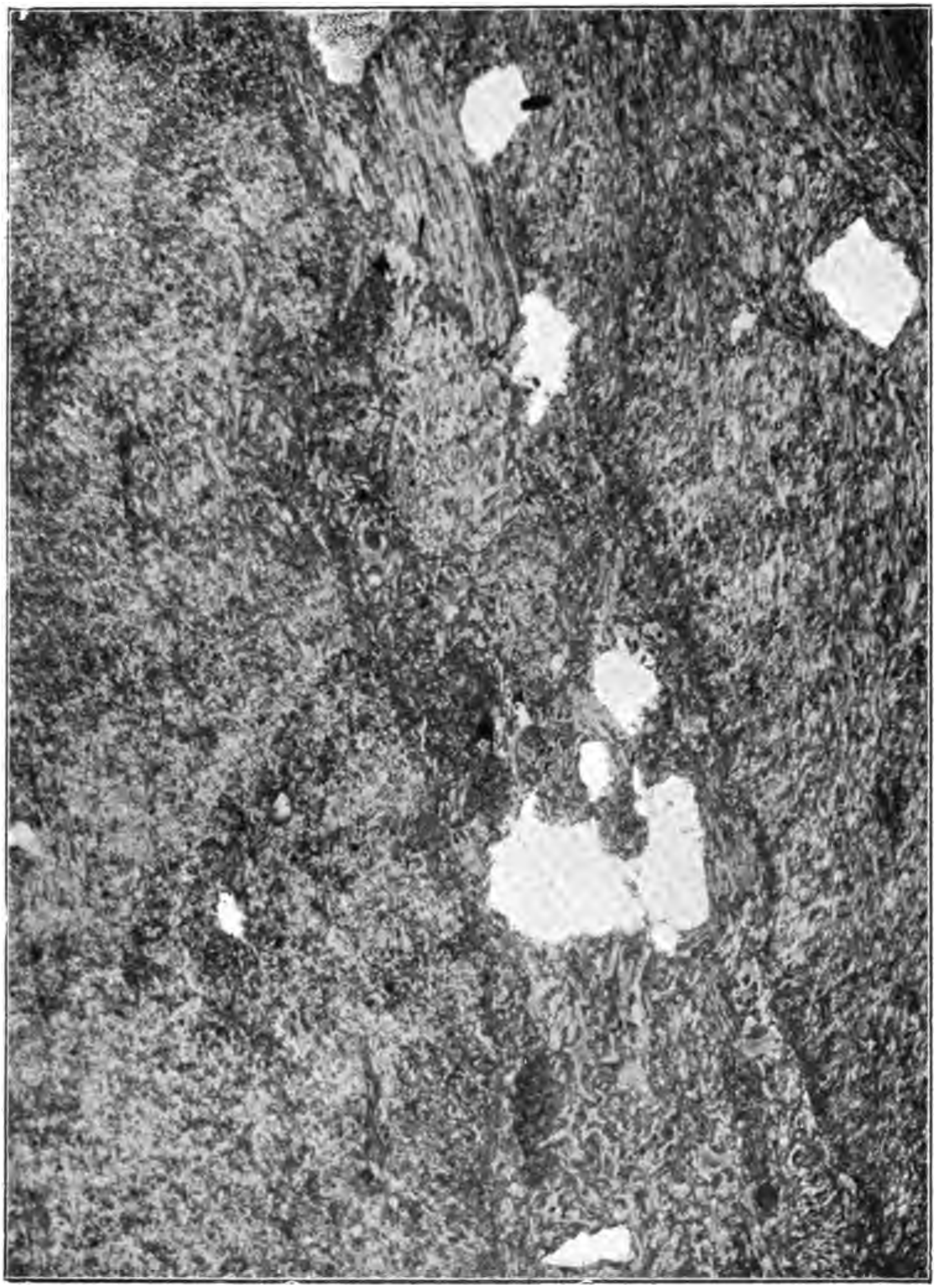
The nature of this rock is somewhat problematical; the remarks made on specimens Nos. 60, 265, 394 apply to it. If attention be fixed on certain portions of the slice, the observer will declare in favour of its being an ash, since broken fragments of glass and pumice of almost every degree of fineness will be found confusedly intermingled in a yellow granular basis; if, however, other parts of the slice be examined the verdict will be for a flow rock, since bands of glass streaked in wavy flow-lines can be traced from one end of the slice to the other. Further examination, however, will show that similar flow-like streaks, sharply bounded by transverse fractures at each end, have the appearance of fragments, and yet lie more or less conformable with the general run of the layers; and this suggests that the longer-streaked bands may be merely portions of larger fragments which have fallen flat on descent with the ash. The appearance of the hand-specimen confirms this suggestion.

The tuff-like form of the fragments of brown glass may readily be accounted for without having recourse to an origin in ash, but the large amount of fine granular material filling up the interstices between the fragments is more difficult to explain away. It may, however, be merely an alteration product of a glass which was the last element to consolidate, and of a more unstable character than that which forms the brown shreds. I am inclined to think that this is the case, and that the fluidity of this residual glass, as well as its instability, were due to included water. The microscope offers no disproof of the theory that this rock was once flowing.

Wilsonite.

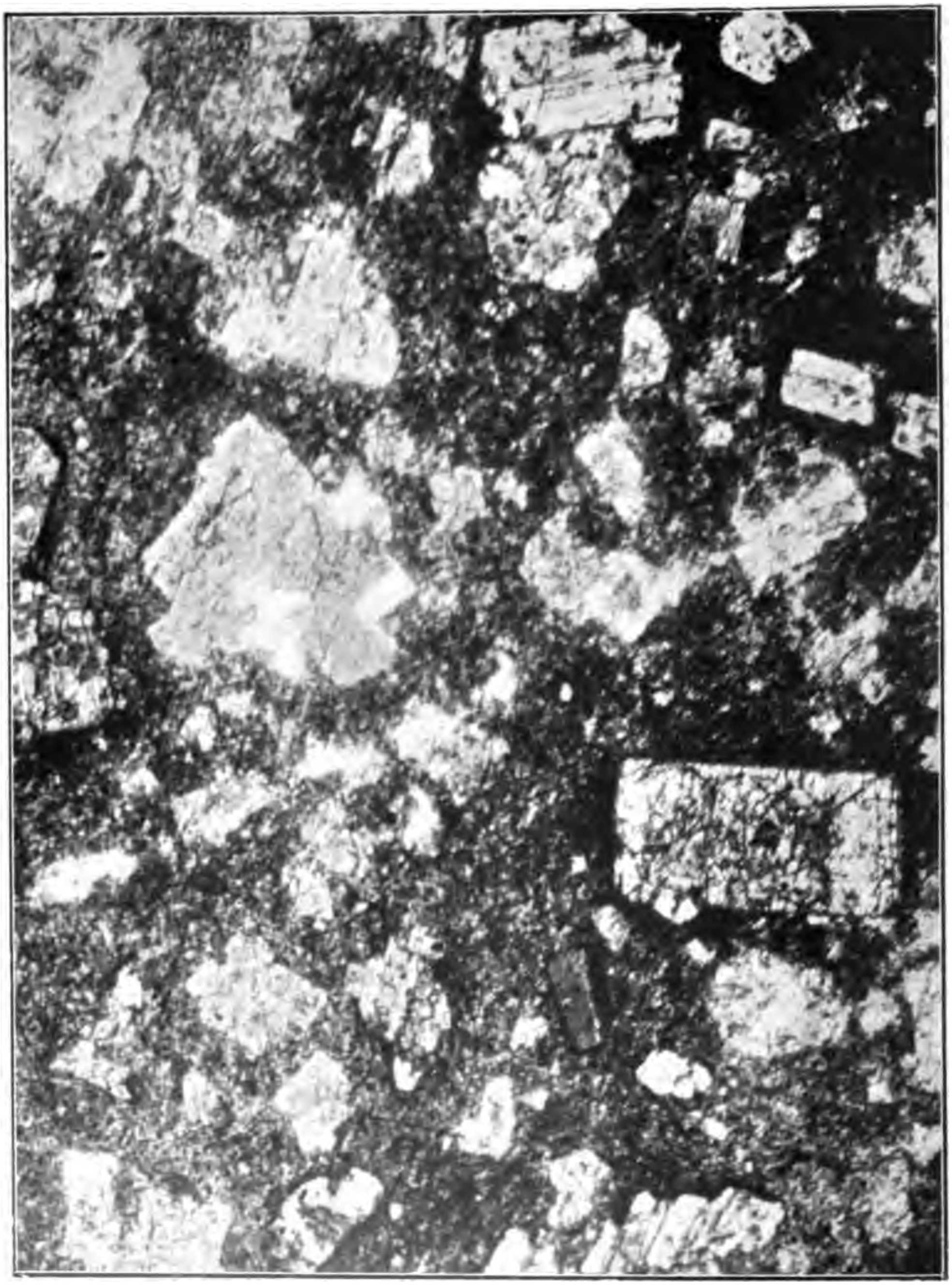
Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower middle, which, on account of the variability of the different parts, is hardly representative of the whole slice.



No. 393/1286. FLOW ROCK (INDETERMINATE).

[*To face p. 138, Vol. II.*



No. 394/1295. ALTERED PYROXENE ANDESITE.

[*To face p. 139, Vol. II.*

Two photo-reproductions of a sample from the same locality are given to face page 66 of the first volume of this report.

Locality.—Quarries near the Waihi - Silverton Battery, Waihi, Ohinemuri County.

Formation.—Acid group of Pliocene age.

Remarks.—This rock covers the greater part of the upper Ohinemuri Plain, and seems to be of later date than the surrounding hills of spherulitic rhyolite.

No. 394/1295.

M.C.—Greyish-green fine-grained rock, with veins of calcite.

U.M.—MATRIX micropœcillitic, with abundant felspar laths in flow-lines, leucoxene granules, chlorite, and carbonates. Matrix about half the rock.

PHENOCRYSTS. — *Plagioclase:* Abundant crystals and complexes, much micacised.

Pyroxene represented by numerous large pseudomorphs in chlorite of more than one kind; one species is strongly pleochroic, green / colourless to green / straw-yellow, carbonates and leucoxene are also usually present. The crystals frequently occur in clusters. In all probability both hypersthene and augite were present in the fresh rock.

Altered Pyroxene Andesite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, upper right, which is characteristic of the whole slice.

Locality.—Grand Junction Mine, Waihi, Ohinemûri County.

Formation.—Kapanga group.

Remarks.—The rocks in the Grand Junction Mine differ considerably from those of Martha Hill and the Waihi Mine, the latter being generally solid lava-flows, while those of the Grand Junction are largely breccia and ash-beds.

No. 395/1309.

M.C.—Black compact rock, with small phenocrysts.

U.M.—MATRIX micropœcillitic, crowded with minute felspar laths in flow-lines, abundant granules of magnetite and leucoxene. Some chlorite and carbonates. Matrix half the rock.

PHENOCRYSTS.—*Plagioclase:* Abundant crystals and complexes, fairly fresh, carbonates beginning to appear; ext., 17°/ 17° (andesine); *r.i.*, above balsam.

Pyroxene represented by numerous rather large pseudomorphs in chlorite (pennine) and carbonates. These include magnetite and a little leucoxene.

Magnetite: A fair number of large grains.

Micropœcillitic Pyroxene Andesite.

Locality.—The Big Tunnel, Waiorongomai, Te Aroha, Piako County.

Formation.—Thames-Tokatea group.

Remarks.—The specimen is from a very thick and solid flow which was being mined in at the time the specimen was taken, and the specimen should be as little decomposed as is likely to be obtained at the same place and from the same bed.

No. 396/1311.

M.C.—Sinter or rhyolite.

U.M.—MATRIX banded in stream-lines; granular quartzose and brown microspherulitic bands alternate with irregular bands of x. Quartz is richly present, giving a granular polarising effect. Magnetite, red ferric hydrate, richly scattered.

PHENOCRYSTS completely transformed, mostly torn out in grinding the slice; fragments of serpentine lining some of the cavities.

Rhyolite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which is characteristic of the whole slice.

Locality.—North side of Kennedy's Bay, Coromandel County.

Formation.—Te Anau series (?).

Remarks.—This specimen may have been derived from the area of Te Anau or Carboniferous rocks on the north side of the bay, or from those forming country east of Tokatea Hill. There are no Pliocene rhyolites nearer than the south side of Mercury Bay, and it is scarcely likely that the boulder on the beach whence the specimen was taken could have been derived from the more distant locality, and consequently it is here referred to the acid rocks of the Palæozoic series.

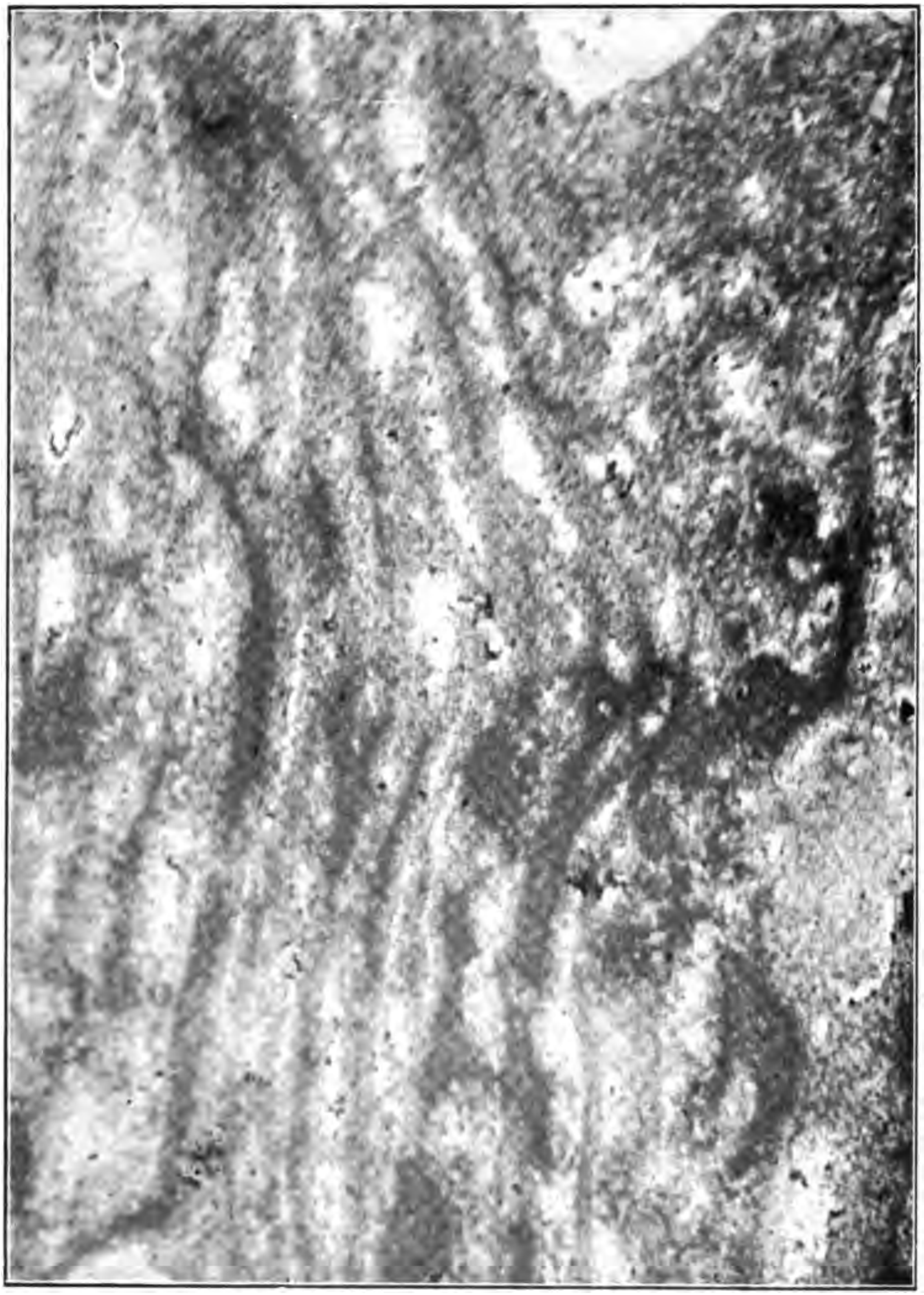
No. 397/1314.

M.C.—Porous brownish-white rock, with phenocrysts of felspar and hornblende.

U.M.—MATRIX much altered, dirty-looking. Probably an altered glass, now giving granular polarisation, some parts chloritic, crystals and complexes of x remain unchanged; leucoxene and other granules dispersed, an occasional felspar lath, granules of brownish-red ferric hydrates, and incipient spherulitic growths.

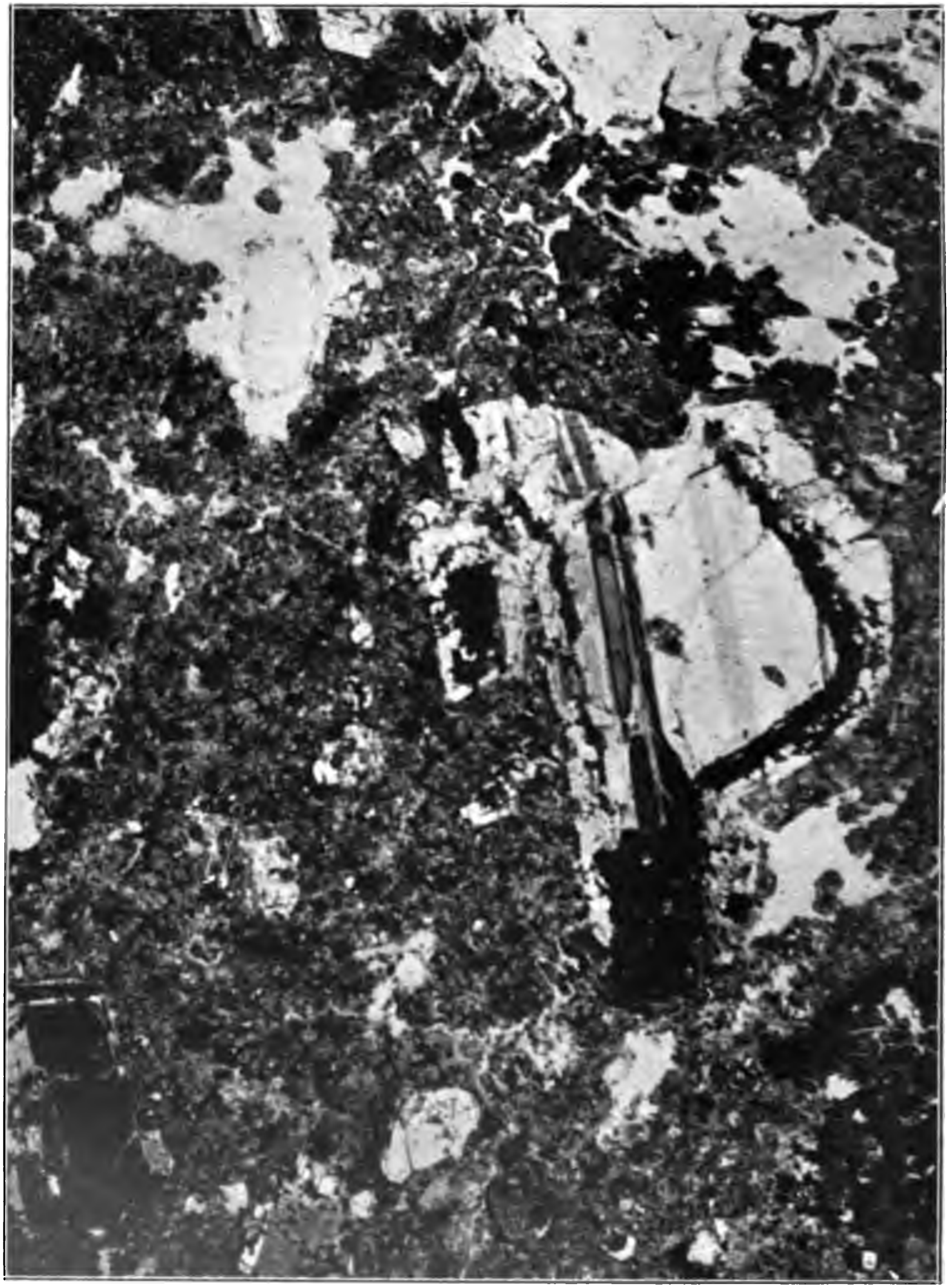
PHENOCRYSTS.—*Plagioclase:* Fairly numerous fresh crystals, complexes, and fragments; *r.i.*, above balsam; ext. 15°/15° (andesine); inclusions various, some submarginal, some a general network of glass now altered into brownish-red ferric hydrate, and some with negative crystals containing water and a bubble.

Pyroxene represented by pseudomorphs of crystals and complexes in greenish serpentine, with included magnetite, ilmenite, leucoxene, and apatite.



No. 396/1311. RHYOLITE.

[*To face p. 140, Vol. II.*



No. 397/1314. HORNBLENDE PYROXENE ANDESITE.

[*To face p. 141, Vol. II.*

Hornblende: Large crystals and fragments, fresh, no reaction border, pleochroism greenish-yellow / deep reddish-brown; ext., almost parallel.

Ilmenite: Several large plates largely converted into leucoxene, leaving hexagonal skeleton net.

Magnetite also present.

Hornblende Pyroxene Andesite.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle part.

Locality.—Matarangi Hill, Matarangi district.

Formation.—Beeson's Island group.

Remarks.—The considerable alteration of this rock may be due to its near proximity to the crater vent of Matarangi Hill.

No. 398/1320.

M.C.—Greenish-grey or black rock, with phenocrysts of greenish felspar, and scattered pyrites.

U.M.—MATRIX very fine-grained, uniform, making up more than half the rock, minutely micropœcillitic, crowded with minute felspar laths in stream-lines, chlorite and leucoxene granules.

PHENOCRYSTS.—*Plagioclase:* Numerous generally more or less rectangular sections in stream-lines, much fractured internally, beginning to undergo alteration, carbonates and mica appearing, chlorite and leucoxene included; ext., 30°/ 30° (labradorite).

Pyroxene represented by numerous pseudomorphs in chlorite (pennine) and carbonates, leucoxene granules included. Pyrites associated.

Ilmenite: Large hexagonal plates, passing into leucoxene.

Pyroxene Andesite.

Locality.—Britannia Mine, western foot of Tokatea Hill, Coromandel County.

Formation.—Kapanga group.

Remarks.—A rock prone to rapid decomposition. Samples were sent with the first batch, but the specimen No. 1320 was thought to be in a better state of preservation.

No. 399/1328.

M.C.—Greyish-black compact rock, streaked with lighter-coloured bands weathering brown.

U.M.—MATRIX: Minutely and obscurely micropœcillitic, crowded with minute felspar laths in stream-lines, with a few prisms of pyroxene, and abundant granules of leucoxene and magnetite.

PHENOCRYSTS.—Brecciated and displaced in a remarkable fashion—a most instructive example of a "flow-breccia," as important amongst volcanic rocks as "crush-conglomerates" among the sedimentary. It will probably throw light on the specimen No. 1286. The nature of the phenocrysts may be first described. They are,—

Plagioclase: *R.i.*, above balsam; ext., various, average about 20°/20° (andesine); fresh. Inclusions colourless glass in rounded cavities and negative crystals, also of matrix.

Pyroxene: Augite almost absent, a few almost colourless fragments.

Hypersthene: Abundant; fresh, with the usual pleochroism, or transformed partly or wholly into green serpentine and carbonates.

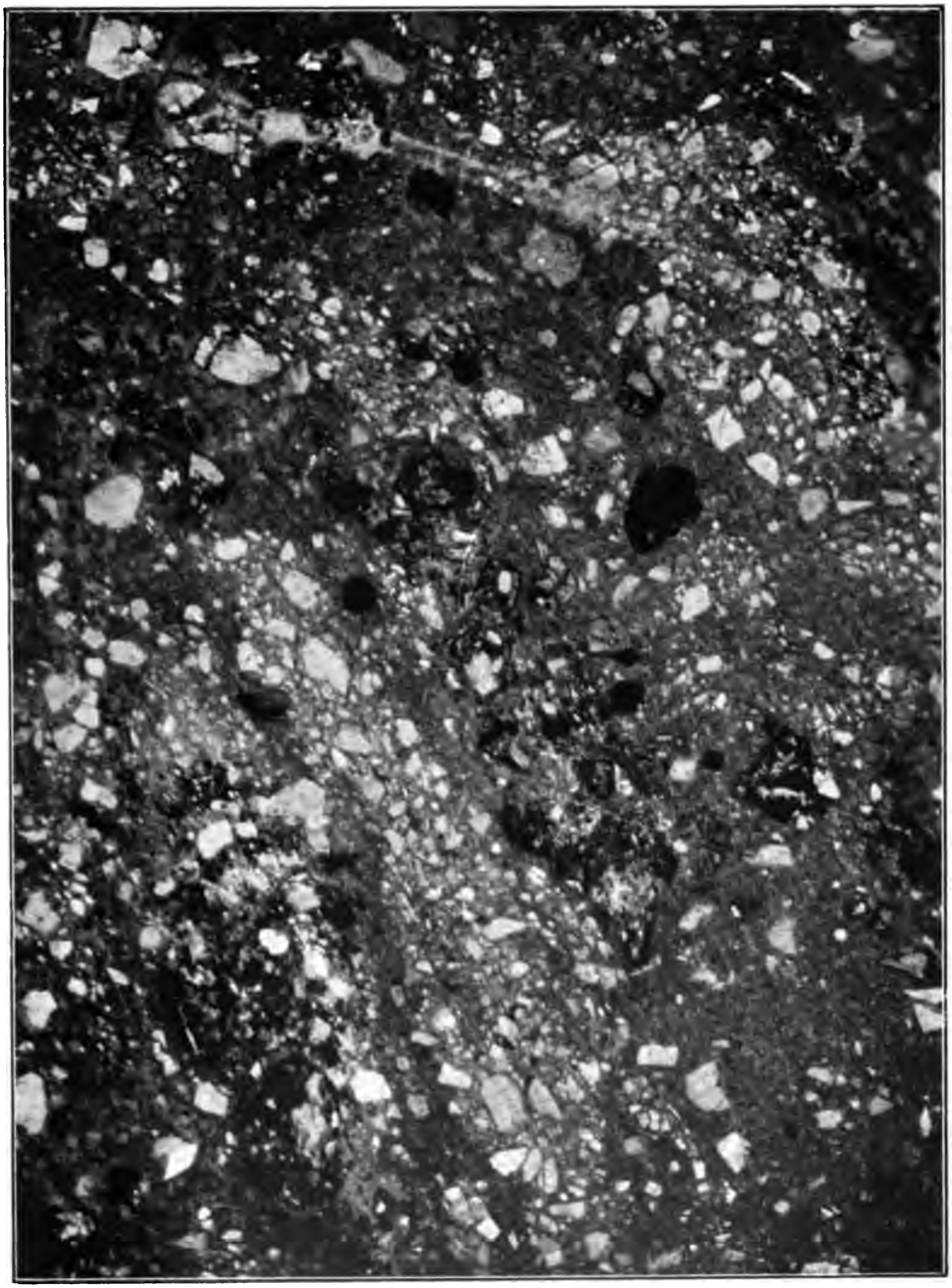
Hornblende: Several crystals and fragments with marked reaction border, pleochroism straw-yellow / green; ext., 12°; decomposing into brownish granular chlorite.

Ilmenite: Large plates, with associated apatite.

The rock is thus a **Hornblende Hypersthene Andesite.**

The lighter streaks weathering brown are portions rich in carbonates and fragmentary phenocrysts.

The phenocrysts have been reduced to small angular fragments, which have been carried along with the flow and distributed in stream-lines, thus giving rise to lenticular streaks, in which felspar predominates, since, as is usual, it was the most abundant phenocryst in the rock. A plane of fracture passes sometimes through an included glass cavity, by which the resulting fragments can be identified lying not far from one another; but is not always possible to correlate the different fragments of each crystal by polarised light, since their original orientation has been lost in subsequent movement. The hornblende presents a thick reaction border round the unbroken margin of a crystal, and a thinner one along the fractured edge, thus showing that the matrix was still sufficiently fluid to react with this mineral after fracture had taken place. Streaks of reaction products may sometimes be seen drawn off from the hornblende along flow-lines. The plagioclase seems to have completely broken up, but some of the hypersthene and hornblende has escaped. The fragmental material has not been carried far, but there are no means of determining how far: in many cases fragments of felspar which were evidently originally parts of one crystal lie very close to each other; in others there are indications of greater dislocation. This example proves the need for caution when referring brecciation to subsequent movements of consolidated rock. The present case might easily be mistaken for one of "mylonitisation."



No. 399/1328. **HORNBLENDE HYPERSTHENE ANDESITE.**

[*To face p. 142, Vol. II.*

Illustration.—Slice shows fair contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which is fairly characteristic of the slice.

Locality.—South side of Kennedy's Bay, Coromandel County.

Formation.—Beeson's Island group.

Remarks.—This rock forms the lower part of a precipitous bluff at the head of the bay. The flow-structure is most peculiar, and gives a schistose appearance to the rock.

No. 400/1331.

M.C.—Dark-grey, compact, coarsely porphyritic rock, with phenocrysts of felspar and hornblende.

U.M.—MATRIX: More than half the rock. Minute bi-pyramids of quartz of very uniform dimensions, not abundant felspar laths and rectangles, chlorite, and not very abundant granules of magnetite and leucoxene.

PHENOCRYSTS.—*Plagioclase:* Numerous large crystals, complexes, and fragments, clear and fresh, zonal, poor in inclusions, glass cavities with bubbles, magnetite, apatite, and hypersthene; ext. 28°/ 35° (labradorite).

Augite: Rare or absent.

Hypersthene: Numerous large and small crystals and fragments, with the usual pleochroism well marked, include a little magnetite and apatite.

Hornblende: Abundant, large and small crystals with reaction borders; ext., 14°; straw- or greenish-yellow / grass-green.

Quartz: A few large corroded grains.

Magnetite: Rather numerous large grains.

Hypersthene Hornblende Dacite.

Locality.—Castle Rock, Waiau district, Coromandel County.

Formation.—A dyke breaking through rocks of the Thames-Tokatea group.

Remarks.—Specimens supposed to be derived from Castle Rock were sent with the first consignment—specially No. 2877. This specimen, No. 1331, is taken from the rock *in situ*, and comparison may therefore be made with the rock from the junction of the Matawai with the Waiau and also with the dykes of Pukewhau and Tiki Creeks.

No. 401/1336.

M.C.—Greyish-black rock, with small phenocrysts of felspar and ferromagnesian minerals.

U.M.—MATRIX: Micropœcillitic, containing abundant minute felspar laths in stream-lines, chlorite scales, magnetite and leucoxene granules, and scattered carbonates.

PHENOCRYSTS.—*Plagioclase :* Numerous crystals, complexes, and fragments, fairly fresh, sprinkled with carbonates; ext., 25°/ 27° (andesine–labradorite).

Pyroxene represented by pseudomorphs in chlorite (pennine) and carbonates. Fairly numerous. A few preserve cores of hypersthene.

Magnetite : Chiefly in association with pyroxene pseudomorphs.

Hypersthene Andesite.

Locality.—Britannia Mine, western foot of Tokatea Hill, Coromandel County.

Formation.—Kapanga group.

Remarks.—Probably a better sample than specimen No. 2933 from the same place.

No. 402/1383.

M.C.—Dark greenish-grey compact rock, with black angular fragments.

U.M.—MATRIX: None in the ordinary sense.

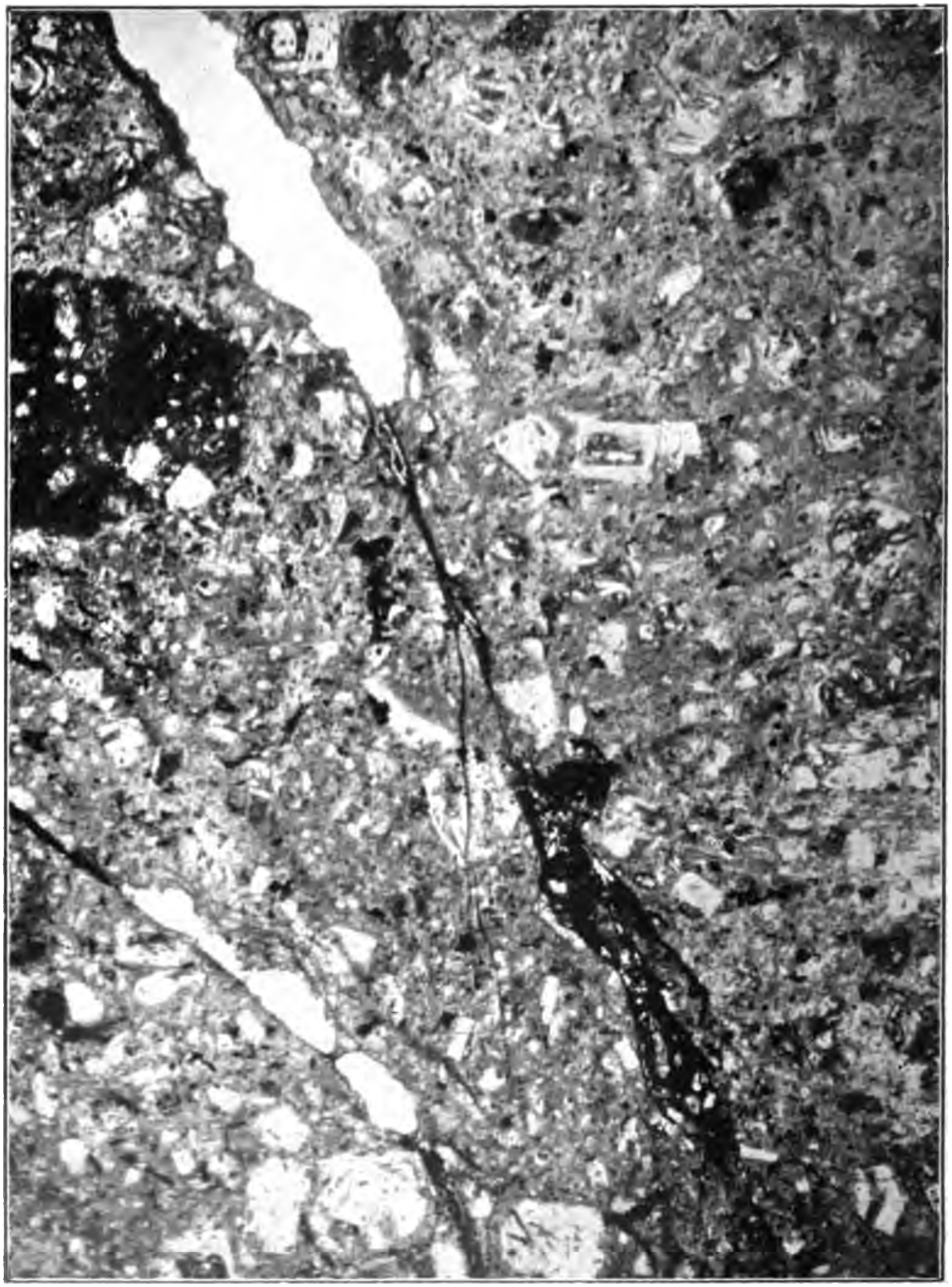
Fragments, irregular in shape, of very various kinds, chiefly different varieties of the groundmass of andesitic rocks; some micropœcillitic with phenocrysts of felspar and of pyroxene represented by chlorite (pennine), many without phenocrysts; micropœcillitic with felspar laths in stream-lines, with magnetite and leucoxene; or altered glass, forming a granular polarising base with square and rectangular sections of small felspar crystals or rarely altered spherulitic material, or the glass may be minutely vesicular, the vesicles filled with chlorite, and the base crowded with felspar laths. Broken crystals of clouded felspar, of pyroxene altered into chlorite (one fresh greenish crystal was observed), and large fragments of quartz dusty with vapour-cavities. The fragments are closely adpressed, but where interstices exist they are filled with brown grauwacke, which appears also to occur in fragments. After deposition the rock was subject to pressure, some shearing took place and gave rise to mylonitised streaks and fissures opened in the direction of pressure, some of which are now filled with chlorite.

A layered **Fragmental Rock,** composed chiefly of volcanic material.

Locality.—Otaheo Stream, south of Kirita Bay, Coromandel County.

Formation.—Beeson's Island group.

Remarks.—This specimen is from one of the isolated patches of volcanic rocks which cap the hills of slate and sandstone south of Kirita Bay.



No. 403/1392. ANDESITE (?).

[*To face p.* 145, *Vol. II.*

No. 403/1392.

M.C.—Greyish-black pitchstone-looking rock.

U.M.—A very extraordinary rock. Phenocrysts of felspar like those of an andesite are scattered through it, but all replaced by some isotropic substance, except some zones which are replaced by quartz. The matrix likewise with its felspar laths is similarly transformed into isotropic material. Magnetite and leucoxene granules are scattered through it. Irregular aggregates of minute quartz bi-pyramids occur in places; they are of very uniform size, and in one place fill a space bounded by outlines like those of a pseudomorph. Some disposed in streaks like the brecciated felspar in No. 399/1328. Traces of pseudomorphs after pyroxene, distinguished by a little surviving fibrous material. A little pyrites associated with the large magnetite grains.

The specific gravity of the powdered rock from 2·2 to 2·3 about; *r.i.*, above 1·41, below 1·445; heated in a closed tube, gives off fumes and water with an acid reaction; hardness about 6. No doubt hyalite or opal. The rock was probably an andesite, and has been replaced by quartz (very little) and hyalite or opal. Most instructive as bearing on "refusion."

Altered Andesite.

Illustration.—Slice shows moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, lower right, which is characteristic of the rest of the slice.

Locality.—North side of Kennedy's Bay, Coromandel County.

Formation.—Beeson's Island group.

Remarks.—The light-grey rocks towards the heads on both sides of Kennedy's Bay are referred to the Beeson's Island group.

No. 404/1423.

M.C.—Greyish-black rock, with phenocrysts of felspar and ferro-magnesian minerals.

U.M.—MATRIX: Colourless glass, crowded with plagioclase laths in stream-lines, and densely charged with magnetite granules. Small prisms of pyroxene also present.

PHENOCRYSTS.—*Plagioclase:* Numerous crystals, complexes, and fragments, some markedly zonal. Inclusions vary greatly in amount. Some crystals almost free, some with a central network of decomposed glass, other with a zonal and submarginal network; ext., 30°/30° (labradorite).

Augite: Faint-green crystals and fragments, fairly numerous, sometimes intergrown with hypersthene.

Hypersthene: Rather abundant, in large crystals and fragments, marked pleochroism of the usual character; includes magnetite which sometimes lies inside a spherical bubble, glass, and apatite.

Magnetite: Very rare, though abundant enough in the matrix.

Hyalopilitic Hypersthene Andesite.

Illustration.—Slice shows good contrasts.

Photographs: (*a.*) By ordinary light; magnification 33 diameters; area photographed, upper right. (*b.*) Magnification, 160 diameters; area, middle part. (*a*) only is characteristic of the whole of the slice.

Locality.—Blind Bay, Great Barrier Island.

Formation.—Beeson's Island group.

Remarks.—So far as known, all the volcanic rocks of the Great Barrier Island are of the age of the Beeson's Island group, and the acid group of Pliocene age.

No. 405/1434.

M.C.—Violet-grey glassy rhyolite, banded in lighter and darker streaks, containing noble opal.

U.M.—MATRIX: Colourless perlitic glass, with streaky structure; some streaks crowded with long linear threads looking like drawn-out vesicles, which run in stream-lines; minute belonites are abundant in some streaks, with an occasional microlith of felspar; in others these are rare or absent. Microscopic spherules of opal, of uniform dimensions, sometimes arranged in regular quincuncial pattern, occur here and there.

PHENOCRYSTS.—*Plagioclase:* Fairly numerous fresh crystals, clusters, and fragments; *r.i.*, about 1·55; ext., 5°/6° (oligoclase–andesine).

Pyroxene: One large transverse section altered into some kind of yellowish serpentinous product, with associated magnetite and zircon.

Quartz in bi-pyramids and rounded grains, abundant.

Glassy Dacite Rhyolite.

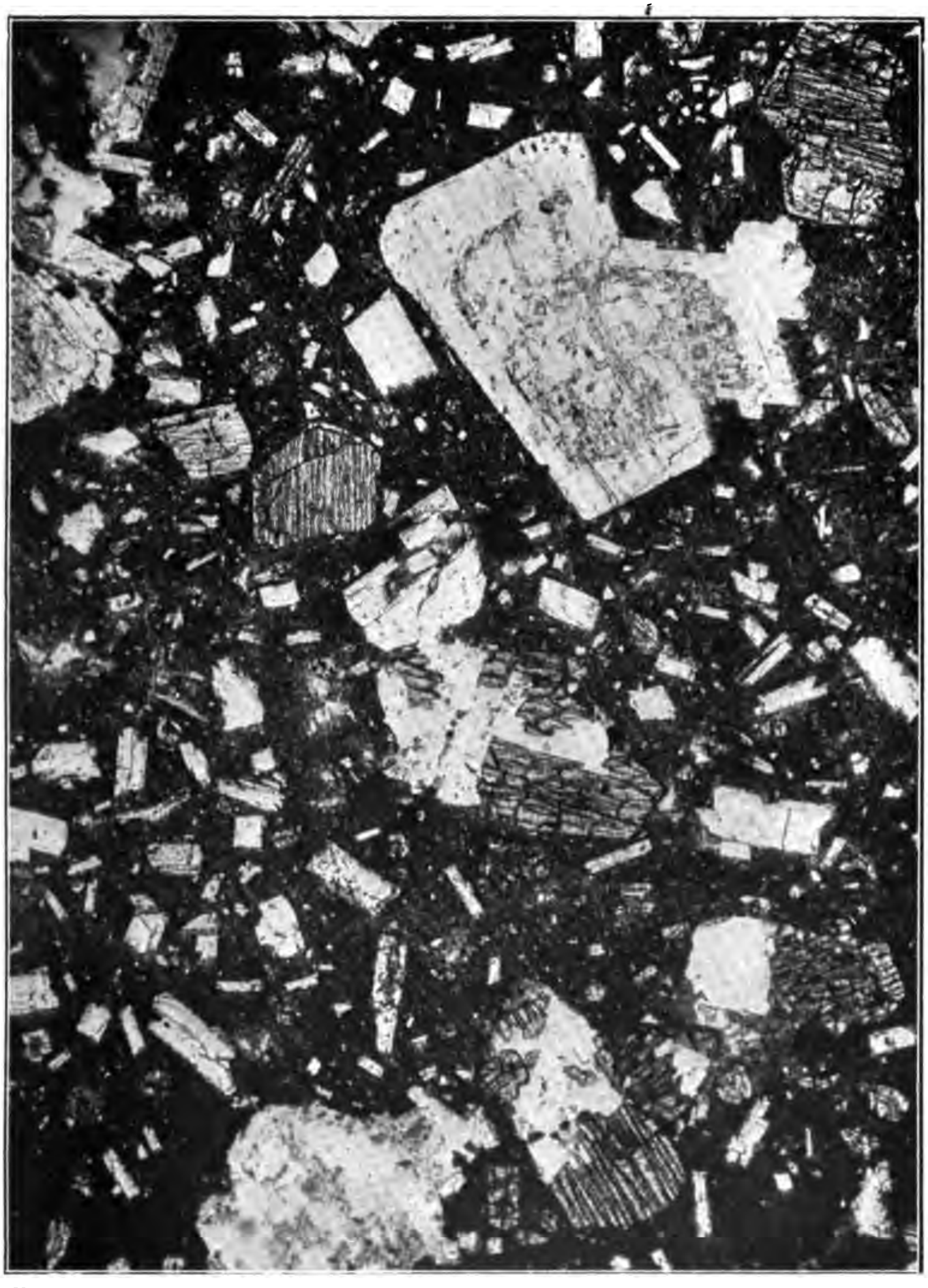
Illustration.—Slice shows but moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, middle part, which shows the pumiceous character of the specimen fairly well.

Locality.—Marsh's farm, Tairua Valley, Thames County.

Formation.—Acid group of Pliocene age.

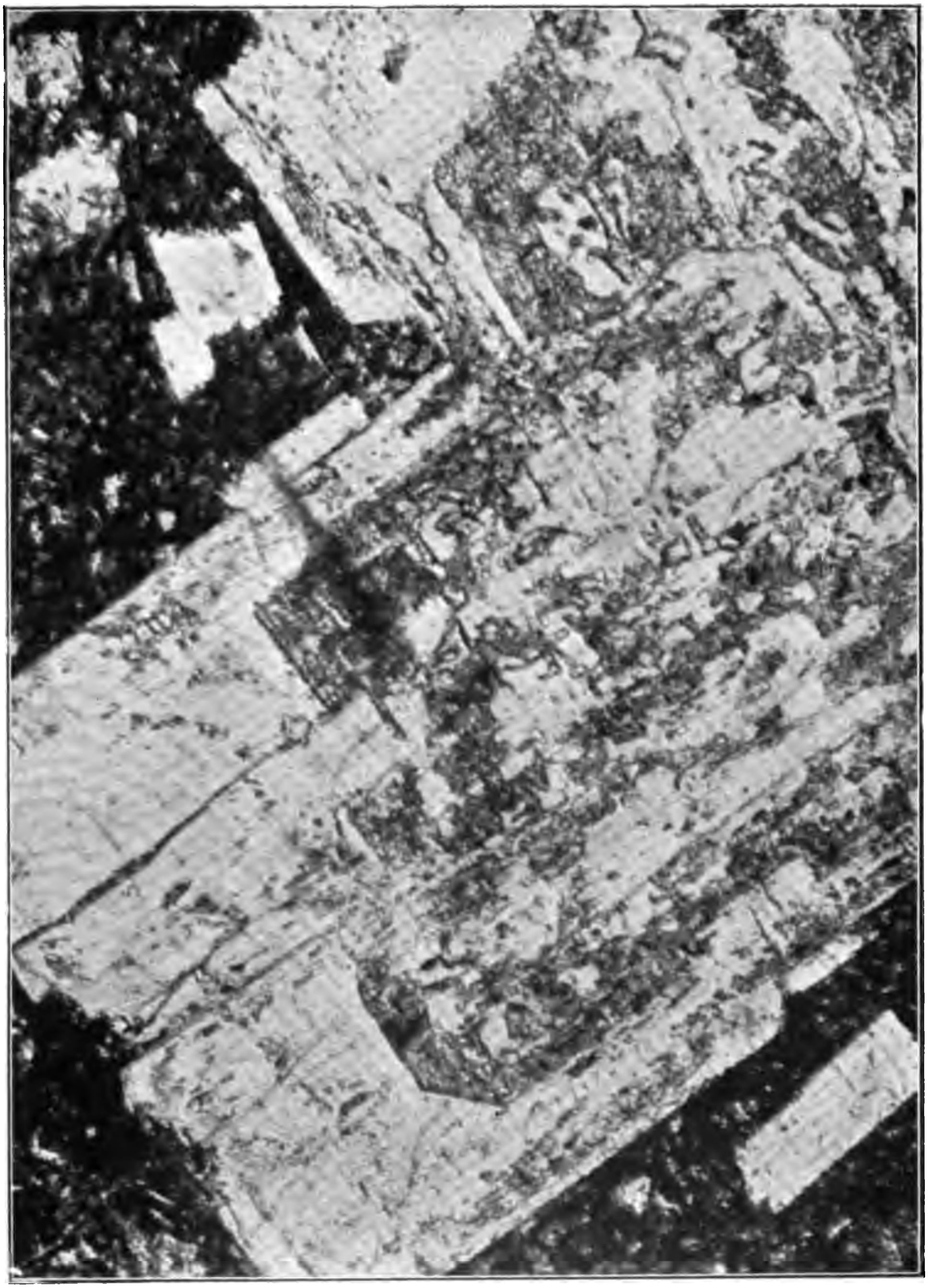
Remarks.—This rock is from the same place as No. 4310. The opal occurs scattered throughout the rock in no regular manner, and in pieces from very small to 2 in. in diameter.



No. 404/1423 (*a*). HYALOPILITIC HYPERSTHENE ANDESITE.

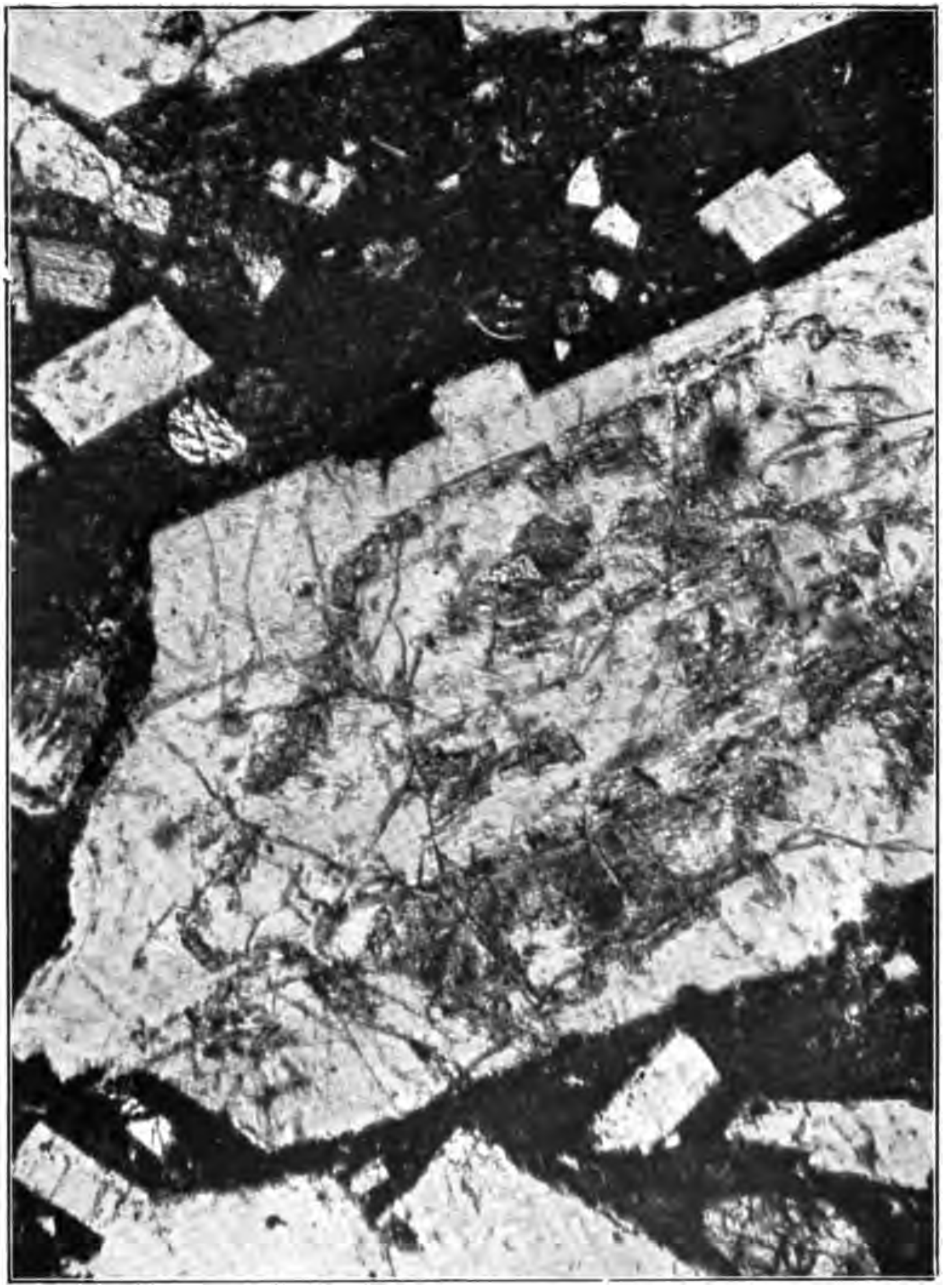
[*To face p. 146, Vol. II.*

i.



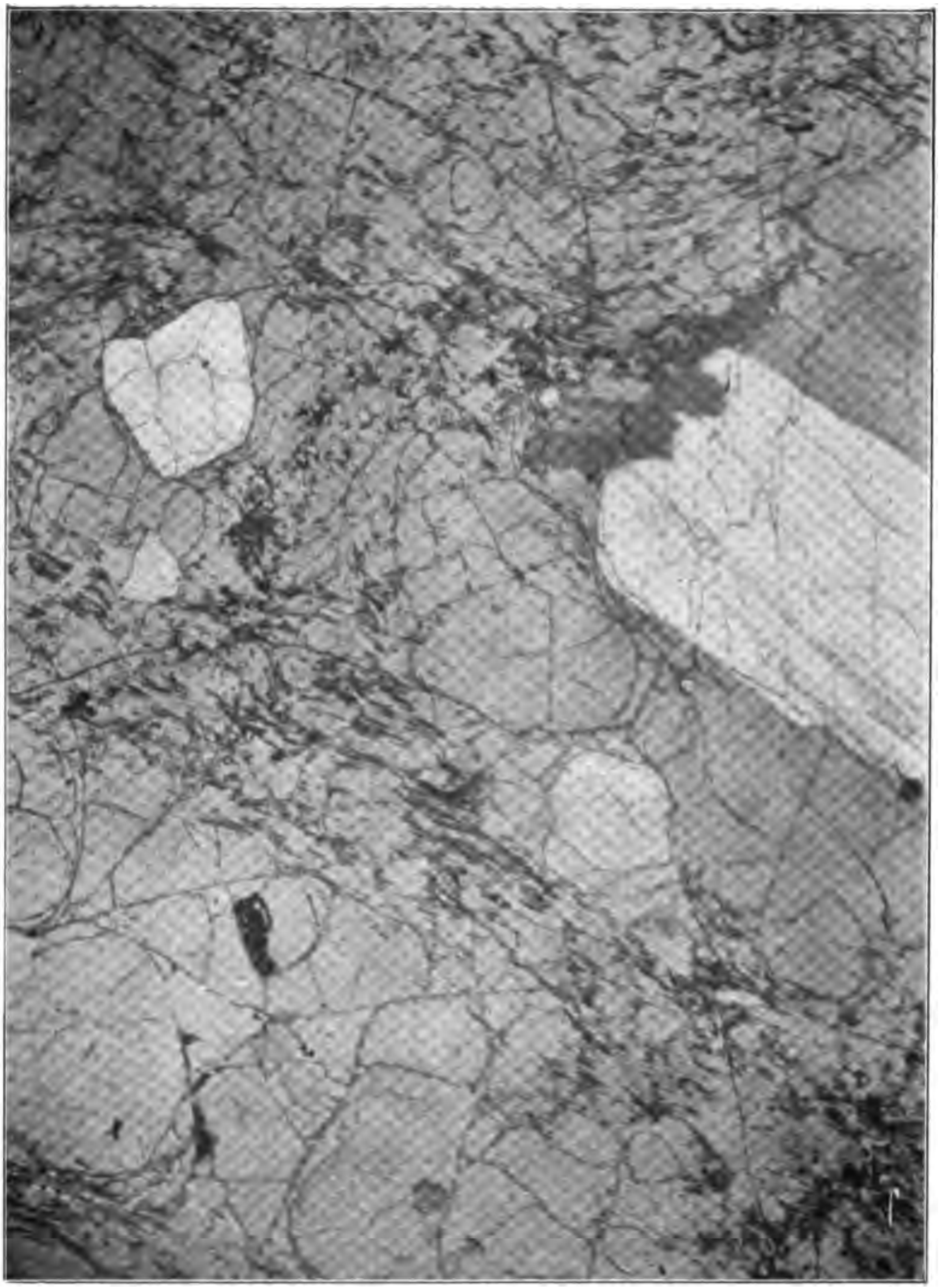
No. 404/1423 (*b*). HYALOPILITIC HYPERSTHENE ANDESITE.

[*To face p. 146, Vol. II.* **ii.**



No. 404/1423 (*c*). HYALOPILITIC HYPERSTHENE ANDESITE.

[*To face p. 146, Vol. II.*
iii.



No. 405/1434.   GLASSY DACITE RHYOLITE.

[*To face p. 146, Vol. II.*
iv.

No. 406/1480.

M.C.—Greyish-white banded rhyolite, crowded with quartz grains.

U.M.—MATRIX : A confused heterogeneous mosaic of quartz, granular with iron hydrates and leucoxene; much more granular in some patches than others; zircons occur.

PHENOCRYSTS.—*Quartz* in very numerous large corroded grains, with vapour and glass cavities, the latter often as large negative crystals. The quartz has grown a little at the margin since consolidation.

No other phenocrysts recognisable; some irregular patches rich in leucoxene are suggestive, but quartz is the only phenocryst surviving.

Silicified Rhyolite.

Locality.—Ohui, on coast south of Tairua River, Thames County.
Formation.—Acid group of Pliocene age.
Remarks.—There are andesic rocks in the district and on the coast-line towards the mouth of the Tairua River; but where mining has been carried on west of the swamp at Ohui there is only rhyolite to be seen at the surface or in the mines examined.

DESCRIPTION

OF

ROCK-SPECIMENS FROM VARIOUS PARTS OF NEW ZEALAND

(Numbered 407-500),

IN CONTINUATION OF "ROCKS OF CAPE COLVILLE PENINSULA,"

BY

WILLIAM JOHNSON SOLLAS, D.Sc., CANTAB.; LL.D., DUBLIN; M.A., OXON.; F.R.S.; F.G.S.;

Fellow of University College, Oxford; and Professor of Geology
in the University of Oxford, England.

WITH NOTES DESCRIPTIVE OF THE PLACE AND GEOLOGICAL POSITION OF THE VARIOUS SPECIMENS

BY

ALEXANDER McKAY, F.G.S., Government Geologist, New Zealand.

List of Rocks from various Parts of New Zealand, comprising the Third Consignment and Two of the Second Consignment sent to England and described by Professor Sollas.

No.	
407/2451.	Ophitic hypersthene andesite. (Near Flat Point, east coast of Wellington.)
408/2521.	Vesicular ophitic hypersthene andesite. (Near Flat Point, east coast of Wellington.)
409/4979.	Teschnite of Wellington. (Red Hill, Brancepeth, east coast of Wellington.)
410/4966.	Teschnite of Wellington. (Red Hill, Brancepeth, east coast of Wellington.)
411/4957.	Teschnite of Wellington, (Red Hill, Brancepeth, east coast of Wellington.)

412/4997. Altered basaltic obsidian.
(Red Hill, Brancepeth, east coast of Wellington.)
413/4774. Fuchsite.
(Dead Horse Gully, Moonlight Creek, Lake County, Otago.)
414/4875. Basalt.
(Wade, west shore of Hauraki Gulf, Auckland.)
415/5023. Granite rendered gneissose by pressure and movement.
(Cape Foulwind, Westport, Nelson.)
416/5026. Hornblende andesite.
(West coast of Wellington.)
417/5027. Vesicular basalt.
(Doctor's Gorge, Waipara River, Canterbury.)
418/4794. Hornblende andesite.
(Sugar Loaves, New Plymouth, Taranaki.)
419/4803. Andesite, containing a little hornblende.
(Sugar Loaves, New Plymouth, Taranaki.)
420/4808. Glassy hornblende andesite.
(Sugar Loaves, New Plymouth, Taranaki.)
421/4824. Hyalopilitic hypersthene andesite.
(Mangamaire Ridge, Kaimanawa Mountains, Wellington.)
422/4829. Rhyolite, or dacite rhyolite.
(Ngaruroro River, Kaimanawa Mountains, Wellington.)
423/4834. Rhyolitic tuff, containing andesine and hypersthene.
(Source of the Mangamaire Stream, Kaimanawa Mountains, Wellington.)
424/4937. Andesic pitchstone.
(Mangamaire Ridge, Kaimanawa Mountains, Wellington.)
425/4839. Glassy microspherulitic andesite.
(Mangamaire Ridge, Kaimanawa Mountains, Wellington.)
426/4851. Microspherulitic andesite.
(Mangamaire Ridge, Kaiamanawa Mountains, Wellington.)
427/4789. Granite.
(Preservation Inlet, west coast of Otago.)
428/4998. Basalt.
(Mason River, Amuri district, Nelson.)
429/4999. Brecciated highly glassy basalt.
(Mason River, Amuri District, Nelson.)
430/5001. Basalt.
(Leader Valley, Amuri district, Nelson.)
431/5008. Silicified rhyolite, or rhyolite tuff.
(Coast Range, Cheviot Hills, Nelson.)
432/5009. Granite.
(Coast Range, Cheviot Hills, Nelson.)
433/5010. Silicified rhyolite.
(Coast Range, Cheviot Hills, Nelson.)
434/5011. Rhyolite, with plagioclase, but without quartz grains.
(Coast Range, Cheviot Hills, Nelson.)
435/5012. Rhyolite, or quartz felsite; perhaps dacite.
(Coast Range, Cheviot Hills, Nelson.)
436/5013. Rhyolite, containing fragments of altered andesite.
(Coast Range, Cheviot Hills, Nelson.)
437/5016. Rhyolite, without quartz grains, but including plagioclase and pseudomorphs of pyroxene.
(Coast Range, Cheviot Hills, Nelson.)

438/5017. Quartzite, a consolidated sandstone.
(Coast Range, Cheviot Hills, Nelson.)
439/5021. Rhyolite.
(Coast Range, Cheviot Hills, Nelson.)
440/4854. Hornblende plagioclase rock, very possibly a transformed dolerite or gabbro.
(Gorge of the Waipaoa River, Poverty Bay, Auckland.)
441/4857. Indurated greensand.
(Gorge of the Waipaoa River, Poverty Bay, Auckland.)
442/4858. Altered andesite, with doleritic structure; or it might be termed a diorite.
(Gorge of the Waipaoa River, Poverty Bay, Auckland.)
443/4860. Pyroxene hornblende gneiss.
(Gorge of the Waipaoa River, Poverty Bay, Auckland.)
444/4865. Basalt, containing some biotite.
(Gorge of the Waipaoa River, Poverty Bay, Auckland.)
445/4933. Hornblende gneiss, containing augite.
(Gorge of the Waipaoa River, Poverty Bay, Auckland.)
446/5029. Hornblende augite gneiss.
(Gorge of the Waipaoa River, Poverty Bay, Auckland.)
447/4823. Rhyolite, or quartz felsite.
(East shore of Palliser Bay, Wellington.)
448/4941. Quartz felsite.
(East shore of Palliser Bay, Wellington.)
449/5030. Rhyolite, with albite.
(East shore of Palliser Bay, Wellington.)
450/5031. Rhyolite, with plagioclase (? andesitic rhyolite).
(East shore of Palliser Bay, Wellington.)
451/5032. Altered micropœcillitic andesite.
(East shore of Palliser Bay, Wellington.)
452/5072. Probably an altered andesite.
(East shore of Palliser Bay, Wellington.)
453/5073. Brecciated rock.
(East shore of Palliser Bay, Wellington.)
454/5075. Altered rhyolite, with plagioclase.
(East shore of Palliser Bay, Wellington.)
455/5077. Altered rhyolite, containing plagioclase.
(East shore of Palliser Bay, Wellington.)
456/5081. Granophyre (of Rosenbusch).
(East shore of Palliser Bay, Wellington.)
457/5086. Spherulitic and micropegmatitic rhyolite.
(East shore of Palliser Bay, Wellington.)
458/5089. Quartz felsite.
(East shore of Palliser Bay, Wellington.)
459/5093. Rhyolite, containing plagioclase.
(East shore of Palliser Bay, Wellington.)
460/5095. Micrographic albite granite, or mica diorite.
(East shore of Palliser Bay, Wellington.)
461/5096. Foliated granite.
(East shore of Palliser Bay, Wellington.)
462/1427. Serpentinised olivine pyroxene rock.
(Champion Mine, Dun Mountain Range, Nelson.)
463/1482. Muscovite rock.
(Rocky Point to Taipo Gorge, Teremakau Valley, Westland.)

464/1486. Mica schist, containing garnets.
(Arahura Valley, Westland.)
465/1493. Serpentine schist.
(Arahura Valley, Westland.)
466/1494. Epidote amphibole rock.
(Arahura Valley, Westland.)
467/1497. Amphibole quartz biotite garnet schist.
(Arahura Valley, Westland.)
468/1500. Garnet actinolite biotite schist.
(Arahura Valley, Westland.)
469/1502. Quartz garnet biotite schist.
(Arahura Valley, Westland.)
470/1503. Amphibole epidote quartz schist.
(Gorge of the Hokitika River, Westland.)
471/1504. Tremolite calc-schist.
(Gorge of the Hokitika River, Westland.)
472/1505. Talc serpentine rock, containing amphibole and dolomite
(Gorge of the Hokitika River, Westland.)
473/1526. Green serpentine schist.
(Arahura Valley, Westland.)
474/1527. Chlorite schist.
(Arahura Valley, Westland.)
475/1529. Quartz garnet amphibole schist.
(Arahura Valley, Westland.)
476/1532. Quartz amphibole biotite epidote schist.
(Arahura Valley, Westland.)
477/1537. Quartz biotite garnet schist.
(Arahura Valley, Westland.)
478/1539. Tremolite serpentine magnetite schist.
(Arahura Valley, Westland.)
479/1548. Green amphibole quartz schist.
(Arahura Valley, Westland.)
480/1551. Granitite.
(Turiwhate, Teremakau Valley, Westland)
481/1553. Dunite.
(Gorge of the Hokitika River, Westland.)
482/1564. Garnet actinolite schist.
(Arahura Valley, Westland.)
483/1572. Amphibole serpentine schist.
(Arahura Valley, Westland.)
484/1576. Garnet mica schist.
(Arahura Valley, Westland.)
485/1583. Serpentine schist, containing tremolite.
(Gorge of the Hokitika River, Westland.)
486/1584. Biotite mica schist, containing amphibole and calcite.
(Arahura Valley, Westland.)
487/1586. Phyllite.
(Jackson's, Teremakau Valley, Westland.)
488/1587. Quartz biotite schist.
(Arahura Valley, Westland.)
489/1594. Dolomite serpentine schist.
(Arahura Valley, Westland.)
490/1595. Amphibole rock.
(Arahura Valley, Westland.)

491/1596. Garnet-bearing biotite mica schist.
(Arahura Valley, Westland.)
492/1600. Amphibole garnet magnetite schist.
(Arahura Valley, Westland.)
493/1601. Altered olivine rock.
(Teremakau Valley, Westland.)
494/1611. Dolomite serpentine tremolite schist.
(Gorge of the Hokitika River, Westland.)
495/1623. Dolomite talc schist.
(Gorge of the Hokitika River, Westland.)
496/1631. Amphibole schist, with magnetite and pyrites.
(Arahura Valley, Westland.)
497/1638. Amphibole epidote schist.
(Arahura Valley, Westland.)
498/1646. Amphibole rock.
(Arahura Valley, Westland.)
499/1662. Hornblende epidote rock.
(Arahura Valley, Westland.)
500/4742. Talc dolomite schist.
(Gorge of the Taipo River, Teremakau Valley, Westland.)

DESCRIPTION OF SPECIMENS.

No. 407/2451.

M.C.—Greenish-black rock, with lustre mottling and brilliant scales of magnetite.

U.M.— Resembles specimen No. 2521, but with coarser grain and without vesicles. The larger plagioclase laths of No. 2521 have here become much further developed; the pyroxene and magnetite are also grown, so that a distinction might be drawn between these and the smaller crystals as between phenocrysts and matrix.

Plagioclase : This shows lamellar twinning, with extinction 15°/ 17°, 20/° 20°, and *r.i.* above balsam. It includes magnetite, augite, and serpentine after hypersthene. The augite is colourless or faint-brown, and is ext. at 39°, and is passing into serpentine and carbonates.

Hypersthene : This has been almost completely transformed into these products (*i.e.*, serpentine and carbonates), but on separating the components of the rock a few grains of fresh pleochroic hypersthene were obtained.

The finer-grained portion of the rock consists of pencils of slender felspar fibres, interstitial chlorite, and magnetite granules.

The magnetite of the rock was separated; it is attracted by a weak magnet, but is far less magnetic than ordinary magnetite. An analysis would give results of interest; probably some of the iron is replaced by magnesium and perhaps aluminium. The talc-eismerz of Breithaupt is a magnetite, with weak magnetism of the composition Fe, FeO_4, Kg, FeO_4; and this may be similar. Chester has already described a magnetite from New Zealand containing 7·15 MgO and 4·63 $Mn3O_4$.

Ophitic Hypersthene Andesite.

Illustration.—Slice shows fair contrasts.

Photographed by ordinary light; magnification, 33 diameters; area photographed, middle part, which is characteristic of the rest of the slice, with the exception of a more than usual abundance of the long black rods mentioned in the description of the slice.

Locality.—Near Flat Point, east coast of Wellington.

Formation.—Cretaceous.

Remarks.—The specimen is from a dyke in Cretaceous strata. Tuffs in lower strata give evidence of volcanic action along the east coast of this part of the North Island during Cretaceous times, and to the close of that period the dyke rocks of that district must be referred.

No. 408/2521.

M.C.—Greenish-black rock, with numerous rounded small vesicles filled with carbonates.

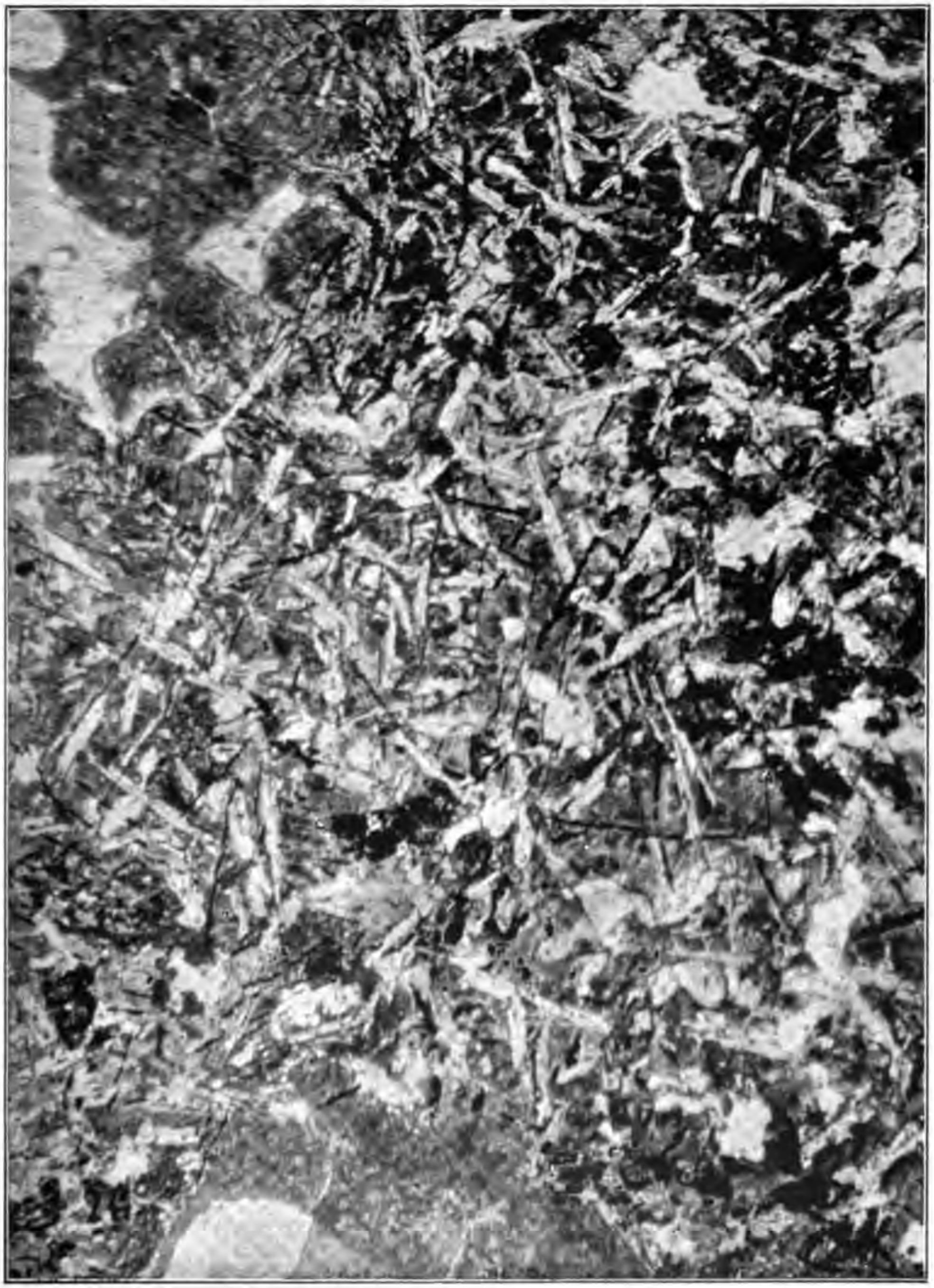
U.M.—MATRIX: Long rather large plagioclase prisms once or twice twinned in radiating arrangement; long rod-like crystals of magnetite, also more or less radiating, and independent of the felspar. In the interstices between these are smaller felspar needles and skeleton crystals, together with green serpentine or chlorite; faintly green, almost colourless augite, ext. 39°, passing into carbonates and serpentine or chlorite. The plagioclase extinguishing at 17°/ 18°. The magnetite sometimes forms skeleton crystals.

Around the vesicles the matrix becomes much finer-grained; the adjacent felspar prisms as they enter this region subdivide into a pencil of radiating smaller laths, the large rods of magnetite disappear and smaller ones take their place. This change does not always take place, and when the larger felspar prisms reach the boundary of a vesicle they are often drawn by surface tension into a position tangental with the wall.

The vesicles may or may not be lined by green clinochlose and orange-coloured hydrophite, which sometimes form alternating bands; they are filled with calcite.

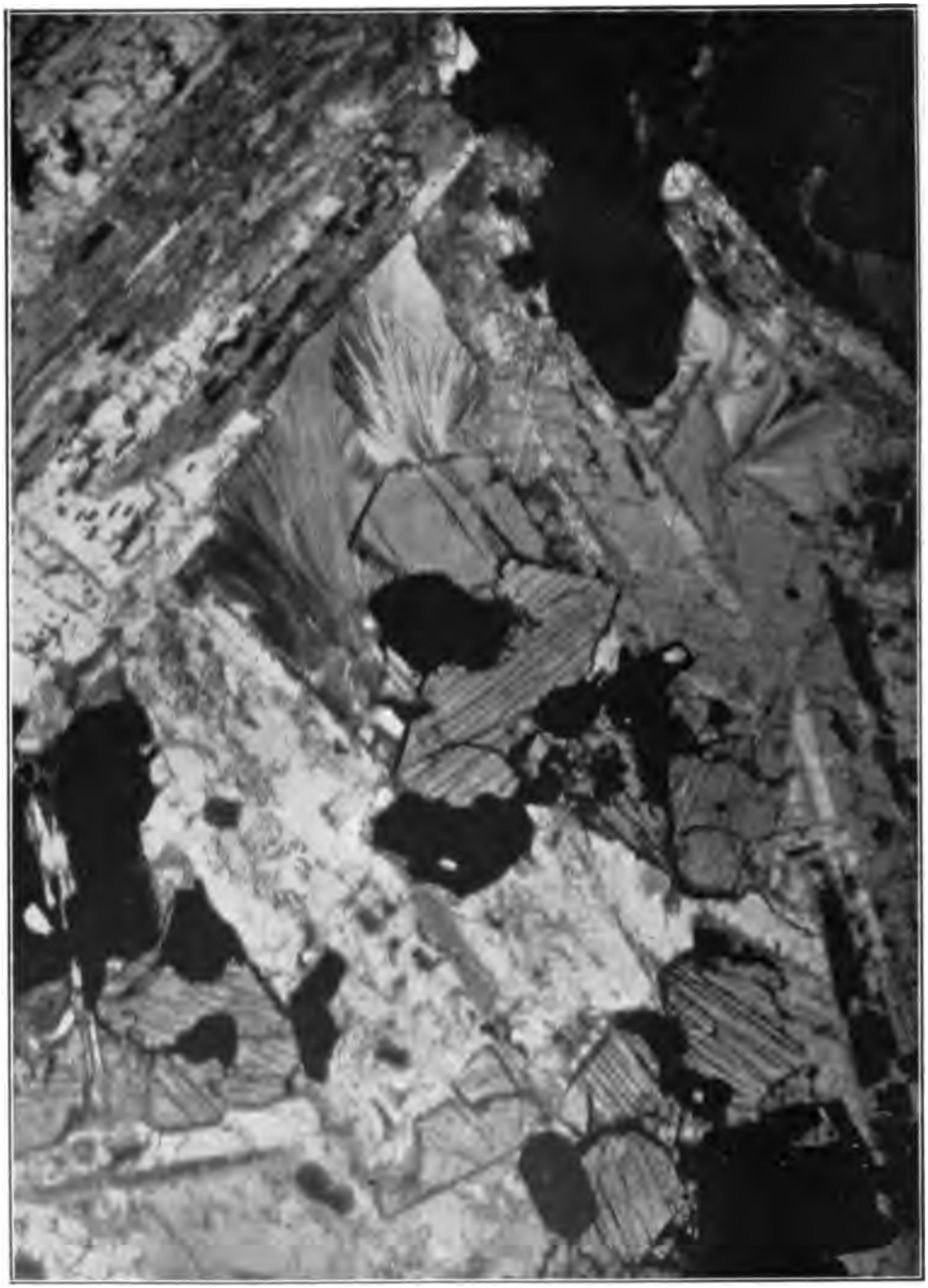
The ophitic structure here displayed is so common in basalt that I have naturally been led to look for olivine, but have not succeeded in finding any of this mineral. Hypersthene was probably originally present, but has been transformed into green serpentine.

Vesicular Ophitic Hypersthene Andesite.



No. 407/2451. OPHITIC HYPERSTHENE ANDESITE.

[*To face p. 154, Vol. II.*



No. 409/4979. TESCHNITE. *[To face p. 155, Vol. II.*

Locality.—East coast of Wellington, near Flat Point.
Formation.—Cretaceous.
Remarks.—The same as for No. 2451.

No. 409/4979.

M.C.—A dolerite-like rock, with abundant idiomorphic augite.

U.M.—The rock is entirely crystalline, and the predominant mineral a violet-brown *augite,* faintly pleochroic, extinguishing up to 44°, generally idiomorphic, enclosing apatite and more commonly magnetite or a black spinellid. In transverse sections of the mineral the pleochroism is very obvious, brownish-yellow / violet-brown.

Plagioclase occurs in plank-like sections, coarsely twinned, often showing zonal extinction ; it contains coarse inclusions of analcine and is frequently much decomposed ; ext., 18° ; *r.i.*, above balsam (andesine).

Orthoclase : Some present.

Biotite, with ferric yellow / ferric red pleochroism, is somewhat sparingly present, usually in close association with the black spinellid and augite.

Apatite occurs in unusually large crystals.

Pseudomorphs in green chlorite(?) occur, and radio-fibrous globular aggregates of the same replacement product are present.

A radio-fibrous zeolite (natrolite?) and analcine occur as an interstitial infilling, and replace much of the plagioclase.

The order of the consolidation is (1) apatite, (2) magnetite and black spinellid (titaniferous magnetite), (3) augite, (4) biotite, (5) plagioclase.

The rock is therefore a teschnite, without hornblende, and with an unusual development of black spinellid (titaniferous magnetite). It is a well-marked variety of the typical rock, and must be distinguished as the

Teschnite of Wellington.

Illustration.—Slice shows fair contrasts, and exhibits the structure of the rock excellently well.

Photographed by ordinary light ; magnification, 33 diameters ; area photographed, that part in which the fan-shaped zeolites are most abundant. The reproduction is a faithful rendering of the part of the slice to which it refers.

Locality.—Brancepeth Run, on the east coast of Wellington, between the Whareama and the Pahau Rivers.

Formation.—Appears to fill the neck of an old volcano that, breaking through Cretaceous rocks near to where the latter makes junction with Palæozoic sandstones, would indicate a Post-cretaceous age ; but, as tuffs and dykes of igneous rocks occur in connection with adjacent rocks of that age, eruptions from this vent probably took place after the lower strata belonging to the Cretaceous period had been laid down and before the higher beds had been deposited.

Remarks.—Red Hill, from whence the specimen comes, is situated at the foot of the Brocken Range, and rises from comparatively level ground some 250 ft. or 300 ft. It is partly surrounded on the southern side by a deep, narrow ravine, which has been formed along the junction of the sedimentary and volcanic rocks. The cutting of this ravine has been aided greatly by the decomposed and pulverent condition of the volcanic rocks near the walls of the crater. Elsewhere on Red Hill the rocks are hard, and show no signs of decomposition.

No. 410/4966.

M.C.—Identical with those of Nos. 4957 and 4979.

U.M.—A highly pyroxenic teschnite, with an unusually high percentage of titaniferous magnetite but no hornblende.

Teschnite of Wellington.

Illustration.—Slice shows good contrasts between the dark and lighter minerals. Two illustrations given, one photographed by polarised light; magnification, 33 diameters; the other by ordinary light. The first shows well the general character of the slice, but not better than in the second taken by means of ordinary transmitted light.

Locality.—Red Hill, Brancepeth Run, east coast of Wellington.

Formation.—Cretaceous.

Remarks.—The same as for No. 4979.

No. 411/4957.

M.C.—A holocrystalline aggregate almost identical with No. 4979.

U.M.—*Plagioclase:* In plank-like sections; some fairly fresh, but many are completely transformed into analcine and other zeolites.

Augite: Large, numerous, generally idiomorphic crystals, perfectly fresh, violet-brown (indicating the presence of TiO_2), with faint pleochroism; ext., 43°. Magnetite and a little biotite occur as inclusions.

Biotite: In small, scattered, corroded crystals, straw-yellow / rich red-brown. Some rather large crystals converted into chlorite.

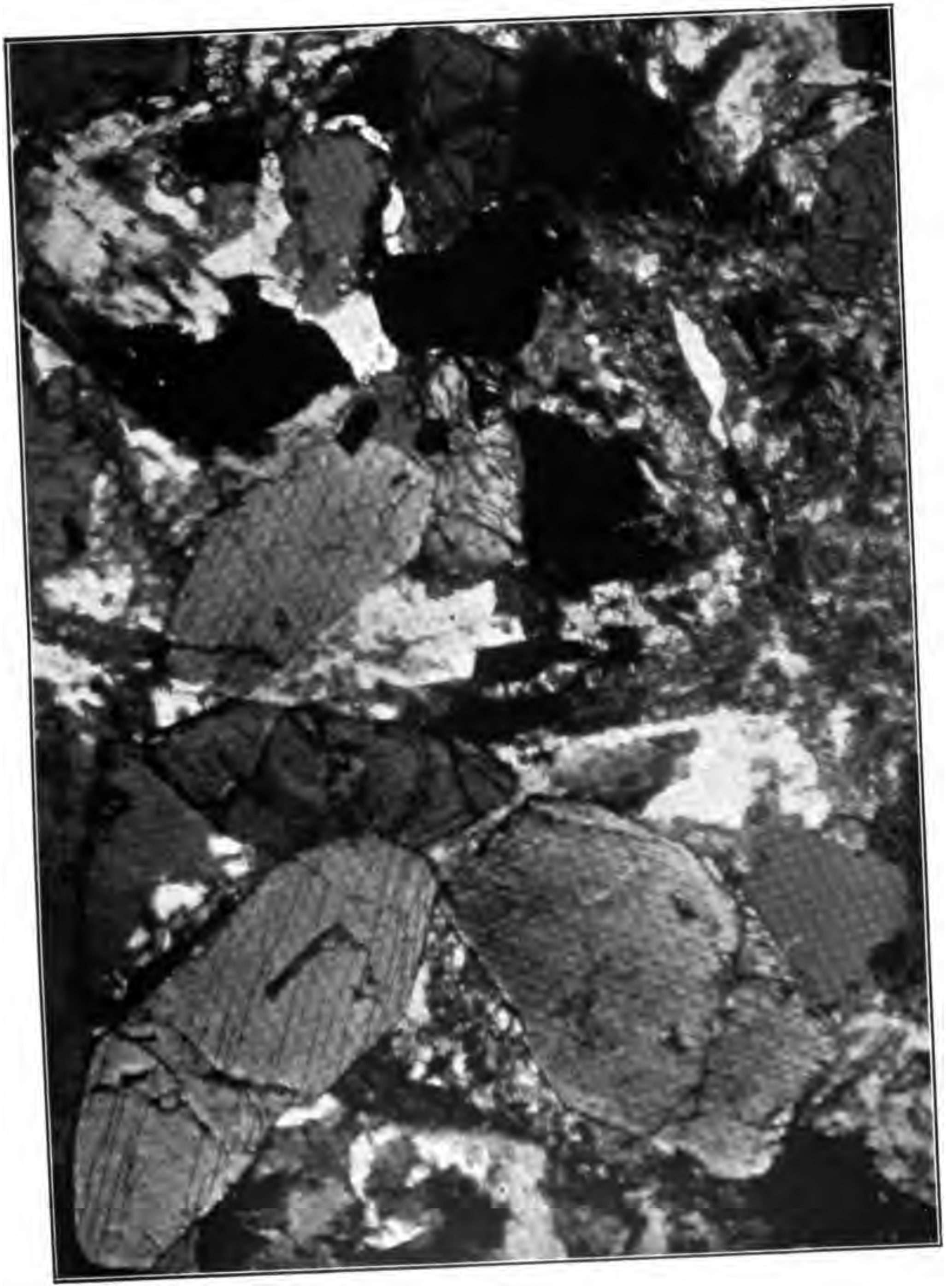
Magnetite and titaniferous magnetite abundant in large well-formed crystals and grains.

Sphene: Some.

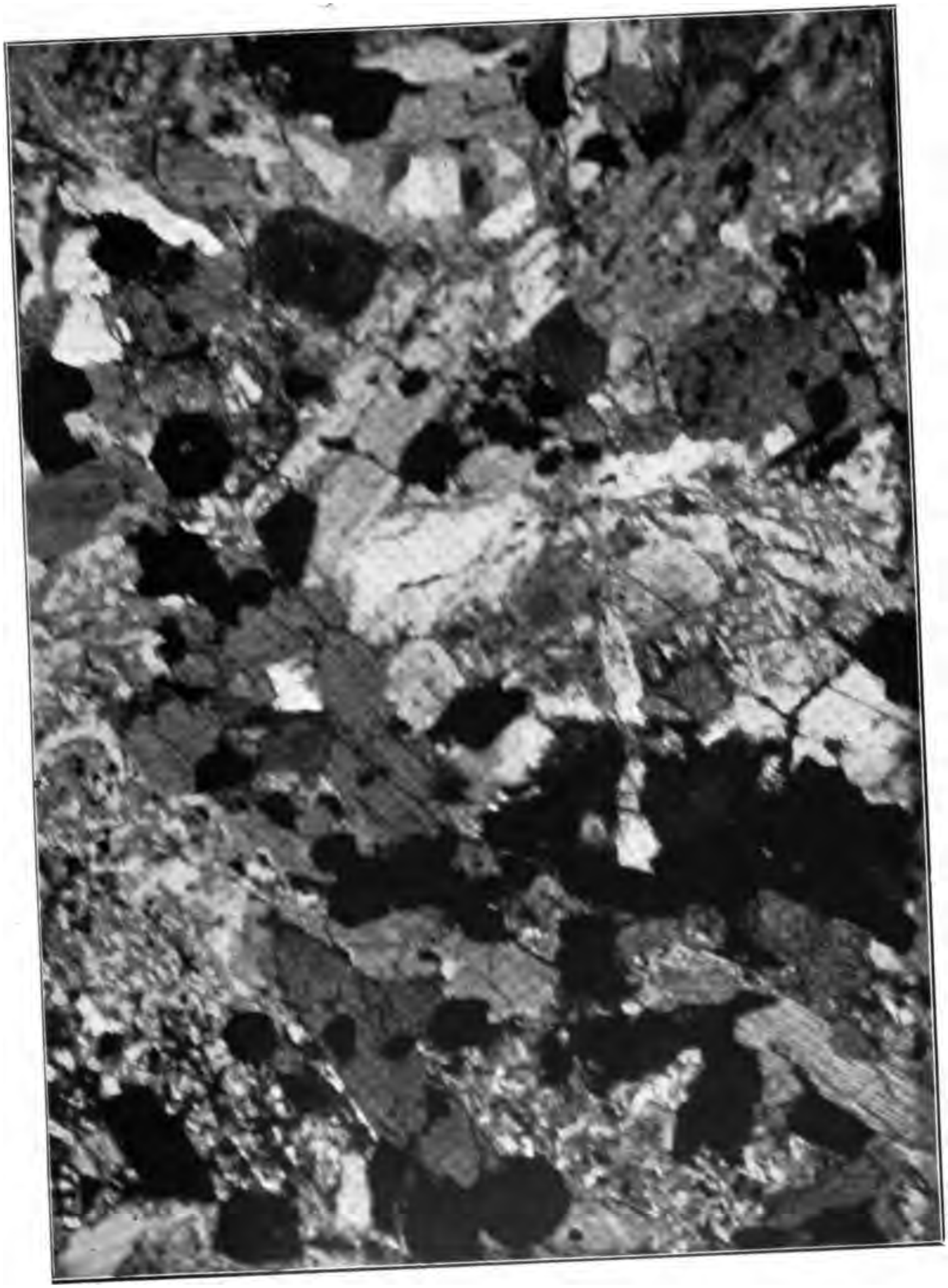
The interstices between the primary minerals are filled with radio-fibrous zeolites and analcine. Some serpentine pseudomorphs after *olivine* are present.

The mineral composition of the rock was found to be as follows:—

Zeolites	24·38
Orthoclase	7·53
Andesine labradorite	4·40
Biotite, with some muscovite	4·40
Pyroxene	43·93
Olivine(?) represented by serpentine	Trace
Magnetite	2·46
Titaniferous magnetite	13·05
	100·15



No. 410/4966 (*a*). TESCHNITE. [*To face p. 156, Vol. II.*
i.



No. 410/4966 (*b*). TESCHNITE. [*To face p.* 156, *Vol. II.* ii.

The zeolites are obviously derived from the plagioclase, so that we may attribute 28·78 per cent. to plagioclase. It reminds one of Kentallenite, described by Messrs. Hill and Kynaston (Quart. Journ. Geol. Soc., 1900, p. 531), from Argyleshire, Scotland; a rock which they correlate with Monzonite (augite syenite), but which I think is more nearly allied to teschnite.

Teschnite of Wellington, distinguished by its richness in titaniferous magnetite.

Locality.—Red Hill, Brancepeth Run, east coast of Wellington.
Formation.—Volcanic, belonging to the Cretaceous period.
Remarks.—The same as given under No. 4979.

No. 412/4977.

M.C.—Dark violet-grey rock, speckled with pyrites and greenish spots.

U.M.—MATRIX: Very finely granular, colourless to brown; colourless parts an irregular mosaic of very faintly double refraction substance, brown, filled with granules of high double refraction, both charged with sheaf-like fibres of colourless amphibole of low double refraction; ext., 15°; sometimes but rarely radiate, and with skeleton crystals and dust of magnetite or opacite.

Numerous pore-like cavities are present.

PHENOCRYSTS.—*Amphibole:* Colourless, and fibrous like that of the matrix, evidently altered; a colourless isotropic mineral occurs between the fibres. Some of the hornblende is green; pleochroism olive-green / almost colourless.

Pyroxene: A few rare corroded crystals, with characteristic form and cleavage; colourless.

Patches of clearer brown granular matrix occur, including colourless pseudomorphs, probably of some ferro-magnesian mineral, perhaps olivine; the colourless replacing mineral (? serpentine) includes sometimes a greenish core and patches of granular pyrites.

Probably an **Altered Basaltic Obsidian.**

Locality.—The outer wall of the ravine which on the south side bounds Red Hill, Brancepeth Run, east coast of Wellington.

Formation.—Cretaceous.

Remarks.—This fine-grained rock was collected as an example of the sedimentaries adjacent to the volcanic neck of Red Hill.

No. 413/4774.

M.C.—Finely foliated mica schist, containing fuchsite.

U.M.—A foliated aggregate of grains of quartz and felspar, of fuchsite and muscovite, and granules of sulphides. Small rutile crystals here and there.

The felspar-like mineral has given me a good deal of trouble, and even now I am unable to identify it. Its specific gravity is about the same as quartz, its refraction index somewhat lower. It sometimes shows polysynthetic twinning, and contains numerous parallel inclusions which give it a streaky appearance.

The only means of identifying it would be to etch the slice by hydrofluosilicic acids.

Fuchsite Schist.

Illustration.—Slice shows moderately good contrasts.

Photographed by polarised light; magnification, 33 diameters; the illustration fairly representing the general character of the slice.

Locality.—Dead Horse Gully, Moonlight Creek, Lake County, Otago.

Formation.—Lower schists of Central Otago.

Remarks.—In the locality of the specimen the bright-green rock forms a band about a foot thick. To the west the schist becomes darker in colour, and lenticular masses of magnetic iron abound in it in that direction, and to a less degree the iron is present in the underlying rocks to the eastward.

No. 414/4875.

M.C.—Violet-grey basalt, porous, with irregular cavities; contains obvious olivine.

U.M.—MATRIX: Confusedly crystalline, rectangular sections of plagioclase, grains of augite and magnetite, the two latter minerals forming a meshwork the interstices of which are filled with felspar.

PHENOCRYSTS.—*Plagioclase:* Labradorite in small plank-like crystals.

Augite: Large crystals and clusters, faint greenish-grey.

Olivine: Colourless in sections, yellow in hand-specimens, fresh, large crystals often broken and corroded by matrix, in rare cases includes ***picotite*** and ***magnetite.***

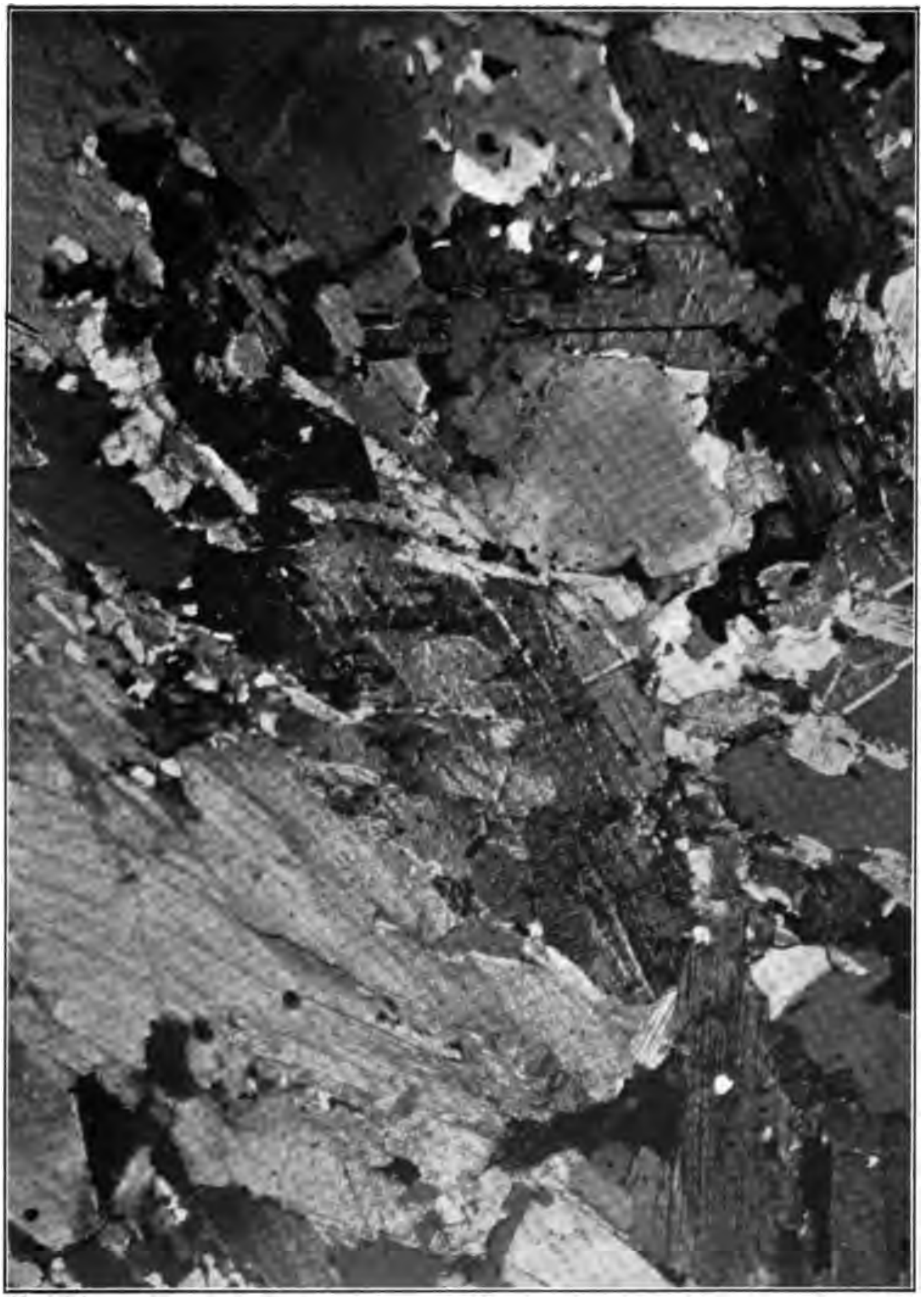
The cavities in this rock are usually empty, but some are lined by radiating tufts of augite immersed in brown glass.

Basalt.

Locality.—Wade, shore of Hauraki Gulf north of Auckland City.

Formation.—Pleistocene or Recent.

Remarks.—This rock though more compact than the highly scoriaceous rocks of the vicinity of Auckland is of the same age and general character.



No. 413/4774. FUCHSITE SCHIST.

[*To face p. 158, Vol. II.*

No. 415/5023.

M.C.—Coarse gneissose granite, with felspar "ungen."

U.M.—*Orthoclase* or *microperthite :* In large crystals, hypidiomorphic, some fairly fresh, some much micacised; marked evidence of pressure frequently present. Some crystals broken and traversed by quartz veinlets; margins of some microgranitic.

Plagioclase : Twinning only faintly seen; ext., 10°; in other respects resembles the orthoclase.

Biotite : Pleochroism straw-yellow / brown; contains zircons, with pleochroic aureole.

Apatite and *sphene :* Chloritised in some cases; often bent, broken, and recrystallized as a result of pressure and movement.

Muscovite : A little, but not much, is present.

Quartz : In coarse mosaics; sometimes broken up into fine granular mosaics, the grains of which are sometimes elongated in one direction.

The quartz and biotite seem to have suffered more than the other minerals from the action of pressure, and when movement has taken place along definite lines the original granite is transformed into good gneiss.

Granite rendered **Gneissose** by pressure and movement.

Locality.—Cape Foulwind, Westport, Nelson.

Formation.—Archaean.

Remarks.—The specimen resembles and is described as having in the *original* been granite, now rendered gneissose by pressure and movement. The rock is assuredly part of the formation of which the Paparoa Mountains are built up; and, though at Cape Foulwind the rock may at one time have been granite, the Paparoa Mountains and north of the Buller Gorge the Papahua Mountains, a continuation of the same chain, show very little granite indeed, but are mostly formed of massive alternations of different varieties of gneiss and mica schist.

No. 416/5026.

M.C.—Grey fine-grained rock, porphyritic, with large black hornblende crystals.

U.M.—MATRIX: A completely crystalline aggregate of plagioclase and augite prisms, with grains of magnetite.

PHENOCRYSTS.—*Palgioclase :* Numerous not large crystals, with tabular habit owing to the development of 010 planes; zonal, with numerous zonal inclusions, amongst which augite may be mentioned; twinning irregular; ext., 30°; labradorite.

Augite : In large crystals and clusters, sometimes twinned, sometimes highly zonal; magnetite sometimes included. Faintly pleochroic. Ext. at 40°.

Hornblende: Large prisms, sometimes rounded, but without marked resorption borders, though corroded by matrix. Pleochroism straw-yellow / bright olive-green, sometimes twinned.

Magnetite: Abundant grains of fairly large size.

Hornblende Andesite.

Locality.—West coast of Wellington.

Formation.—Pliocene(?).

Remarks.—The specimen may have reached the coast-line, where it was collected, grooved artificially, and evidently used as a net-sinker, from either Ruapehu or from Mount Egmont.

No. 417/5027.

M.C.—Brownish fine-grained basalt, rich in round, almost spherical vesicles now filled with calcite.

U.M.—MATRIX: Coarse plagioclase laths, black rods, and skeleton crystals of opacite; pseudomorphs in green serpentine after olivine.

PHENOCRYSTS.—*Plagioclase:* In crystals and clusters, far from fresh, more or less replaced by calcite; in some cases fairly fresh; ext., 0° (andesine).

There are no large phenocrysts.

Vesicles generally filled with calcite, but in one case by plagioclase and radiate rods or fibres of opacite, and a serpentine pseudomorph after olivine.

Vesicular Basalt.

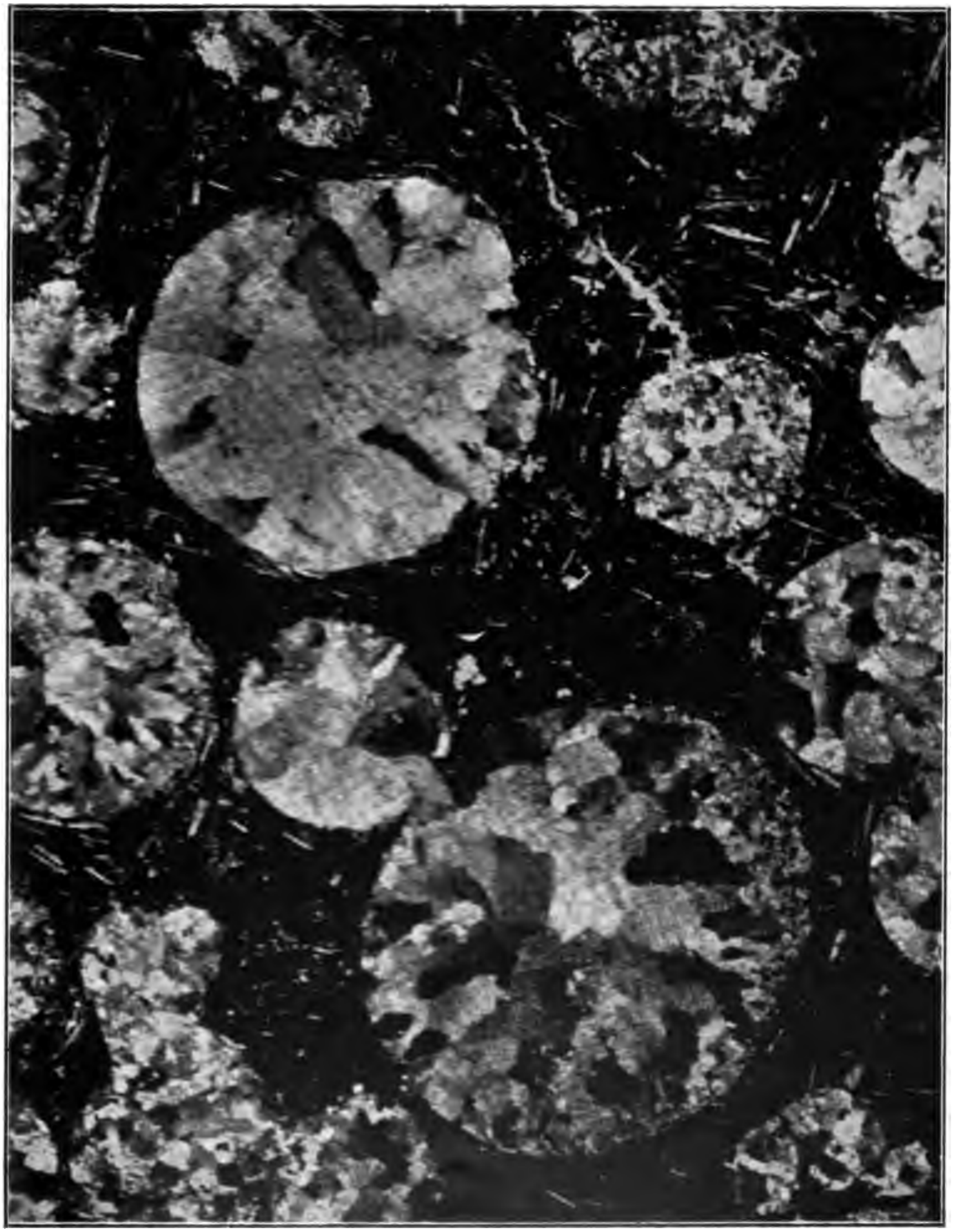
Illustration.—Slice shows good contrast between the infilling of the vesicles and the darker matrix.

Photographed by polarised light; magnification, 33 diameters; the illustration gives a good idea of the character of the slice and the nature of the specimen.

Locality.—Doctor's Gorge, Waipara River, Canterbury.

Formation.—Trias.

Remarks.—The specimen has been derived from the rocks of the Hamilton Range where this is broken through by the Waipara River; but the same rock is found further to the west and north as far as the Waiau-ua Gorge. In the report on the geology of the north-east portion of the South Island, Geological Reports, 1873–74, Captain F. W. Hutton, F.R.S., F.G.S., describes an identical or similar rock from the same formation in the Mandamus Valley west of the Hurunui Plain. His account of the rock *in situ* is interesting, and I may be warranted in giving it here. The report cited, at page 34, says, "In the Mandamus they" [the volcanic rocks of the Maitai formation Lower Jurassic] "occur in a particularly instructive manner, as that river has cut through the neck of an old volcano and exposed a very interesting section. The neck of the volcano is filled with syenite. . . . . Higher up the river, near the Dove, a thick mass of volcanic agglomerate is seen interbedded with the slates, thus proving the date of the volcanic eruptions. . . . . Another good



No 417/5027. VESICULAR BASALT.

[*To face p. 160, Vol. II.*

section is also obtained up a small creek that runs into the Mandamus from the west just opposite the Dove. Here we see three separate lava-streams of vesicular basalt or anamesite dipping 75° west by south parallel to the bedding of the sedimentary rocks. The first of these is 5 ft., the next 3 ft., and the third 10 ft. in thickness. These lava-flows are fine-grained and full of small vesicles, many of which are now filled up with a white mineral. Their structure indicates that they were probably submarine. . . . . The evidence is therefore complete as to the age of the volcanic eruptions."* Immediately south of the sources of the Waipara, at the Brothers in the Okuku watershed, the tuffs and lava-flows above described are present, the former associated with limestones in which abound *Monotis salinaria* var. *Richmondia*, Zittel, and *Mytilus problematicus*, Zittel, both of which are characteristic of the Trias formation near Nelson. The volcanic rocks associated are therefore of considerable interest, and for this reason the sample described was included with the collections sent to England.

No. 418/4794.

M.C.—Grey platy andesite; porphyritic, with plagioclase.

U.M.—MATRIX: Plagioclase laths, colourless augite prisms, and magnetite grains in a colourless microcrystalline base.

PHENOCRYSTS.—*Plagioclase:* Large well-formed crystals, variously twinned, highly zonal; often broken; zonal inclusions, and sometimes a submarginal zone of inclusions; *r.i.*, much above balsam; ext., 8° (andesine).

Hornblende: Pleochroism olive-green / olive-yellow or reddish-brown, with narrow absorption borders of augite and magnetite.

Magnetite: Numerous grains, with included apatite.

Hornblende Andesite.

Locality.—The landward of the Sugar Loaves, New Plymouth, Taranaki.

Formation.—Late Tertiary.

Remarks.—The Sugar Loaves at Taranaki are probably the cores of volcanoes the looser materials surrounding which have been removed by denudation. They thus antedate the eruptions that have built up Mount Egmont to its present height, but at the same time they break through Miocene or Older Pliocene sedimentary deposits.

No. 419/4803.

M.C.—Pebble of light-grey andesite.

U.M.—MATRIX: Not more than one-half the rock; felspar laths in flow-lines; minute augite prisms and magnetite grains.

PHENOCRYSTS.—*Plagiolase:* Rather small well-formed crystals, with zonal inclusions, abundant; ext., 20° (andesine).

---

* Geol. Reports, 1873–74, pp. 34, 35.

Augite: Well-formed crystals; faintly coloured brownish-yellow, sometimes with a core of hypersthene; plentiful.

Hornblende: Small, comparatively rare well-formed crystals, with black resorption borders.

Magnetite grains fairly numerous.

Andesite, containing a little hornblende.

Illustration.—Slice over all parts of it shows good contrasts between the phenocrysts and the matrix.

Photographed by polarised light; magnification, 33 diameters.

Locality.—The landward of the Sugar Loaves, New Plymouth, Taranaki.

Formation.—Late Tertiary.

Remarks.—The Sugar Loaves of Taranaki, with one exception, are surrounded by the sea. The landward Sugar Loaf is the highest, and the most perfect example of a volcanic core from which the surrounding looser materials have been removed.

No. 420/4808.

M.C.—Pebble of black andesite, with white felspar and dark ferromagnesian minerals.

U.M.—MATRIX: Brownish, glassy, with abundant elongated plagioclase microliths in stream-lines; constitutes more than half the rock.

PHENOCRYSTS.—*Plagioclase:* Crystals and composite crystals; twinning irregular; ext., 20° (andesine); central submarginal inclusions of glass.

Augite: Almost colourless, large crystals not common, but many smaller ones; sometimes twinned twice or thrice.

Hornblende: Numerous small and some large well-formed crystals without a resorption border; more abundant than augite. Pleochroism olive-green / brown, sometimes inappreciable; zonal, a zonal margin often present having a different colour to the rest of the crystal.

Biotite: (?)

Magnetite grains very sparingly present.

Glassy Hornblende Andesite.

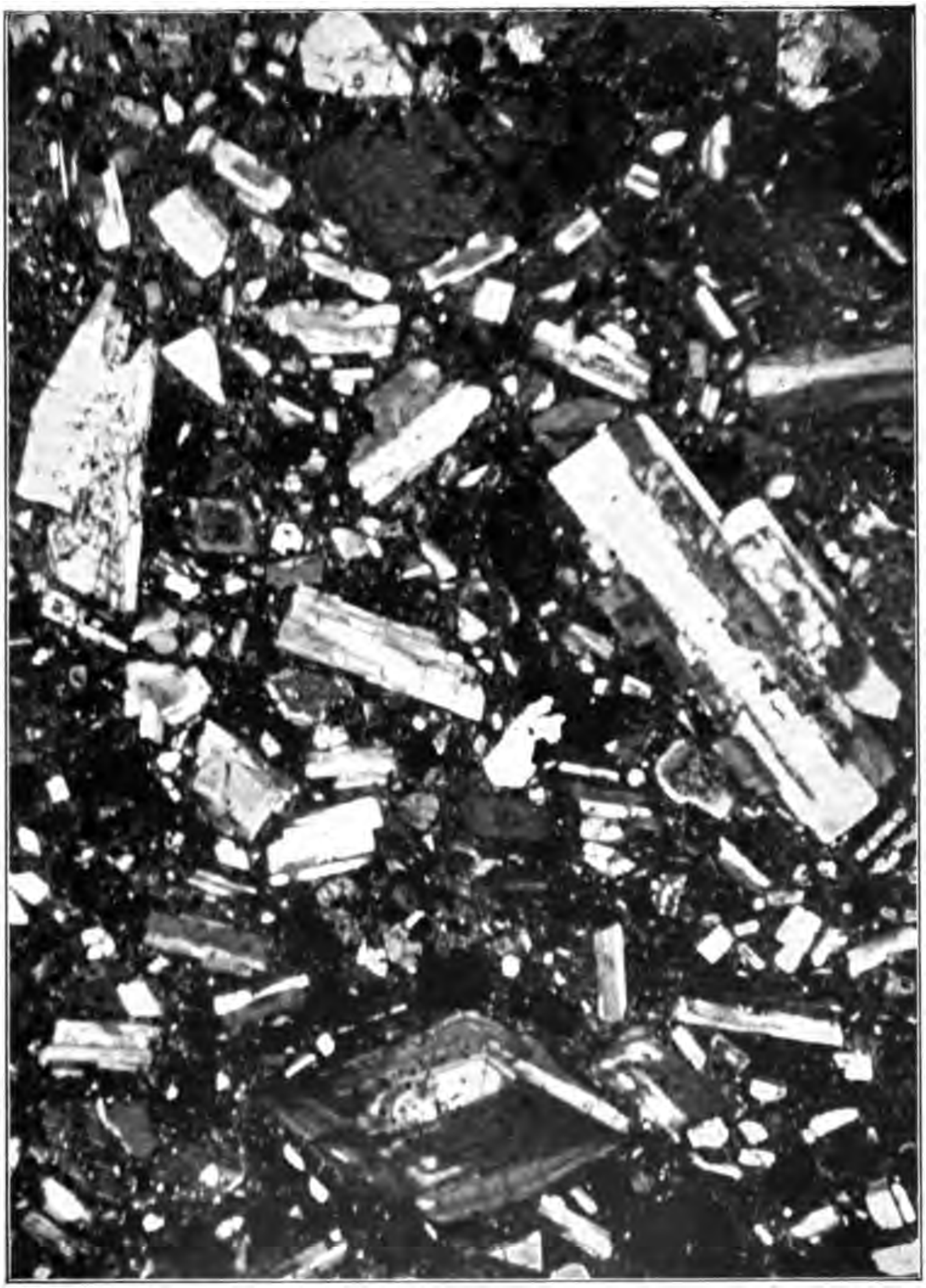
Illustration.—Slice shows fair contrasts between the phenocrysts and the glassy base.

Photographed by polarised light; magnification, 33 diameters; the nicols were crossed only as much as was needed to give the required contrast.

Locality.—The landward Sugar Loaf, New Plymouth, Taranaki.

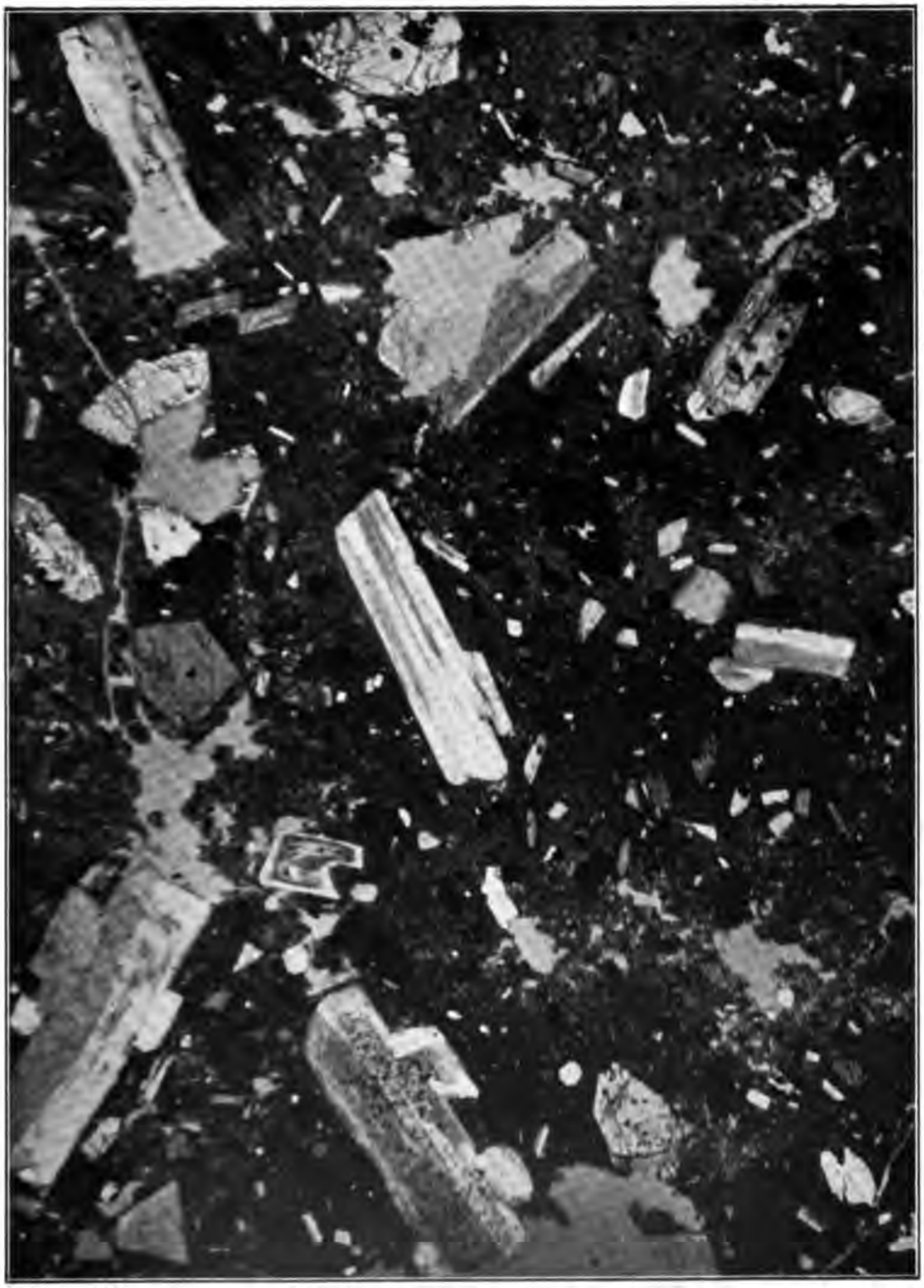
Formation.—Late Tertiary.

Remarks.—Specimen from the base of the sea-face of the landward Sugar Loaf.



No. 419/4803. ANDESITE.

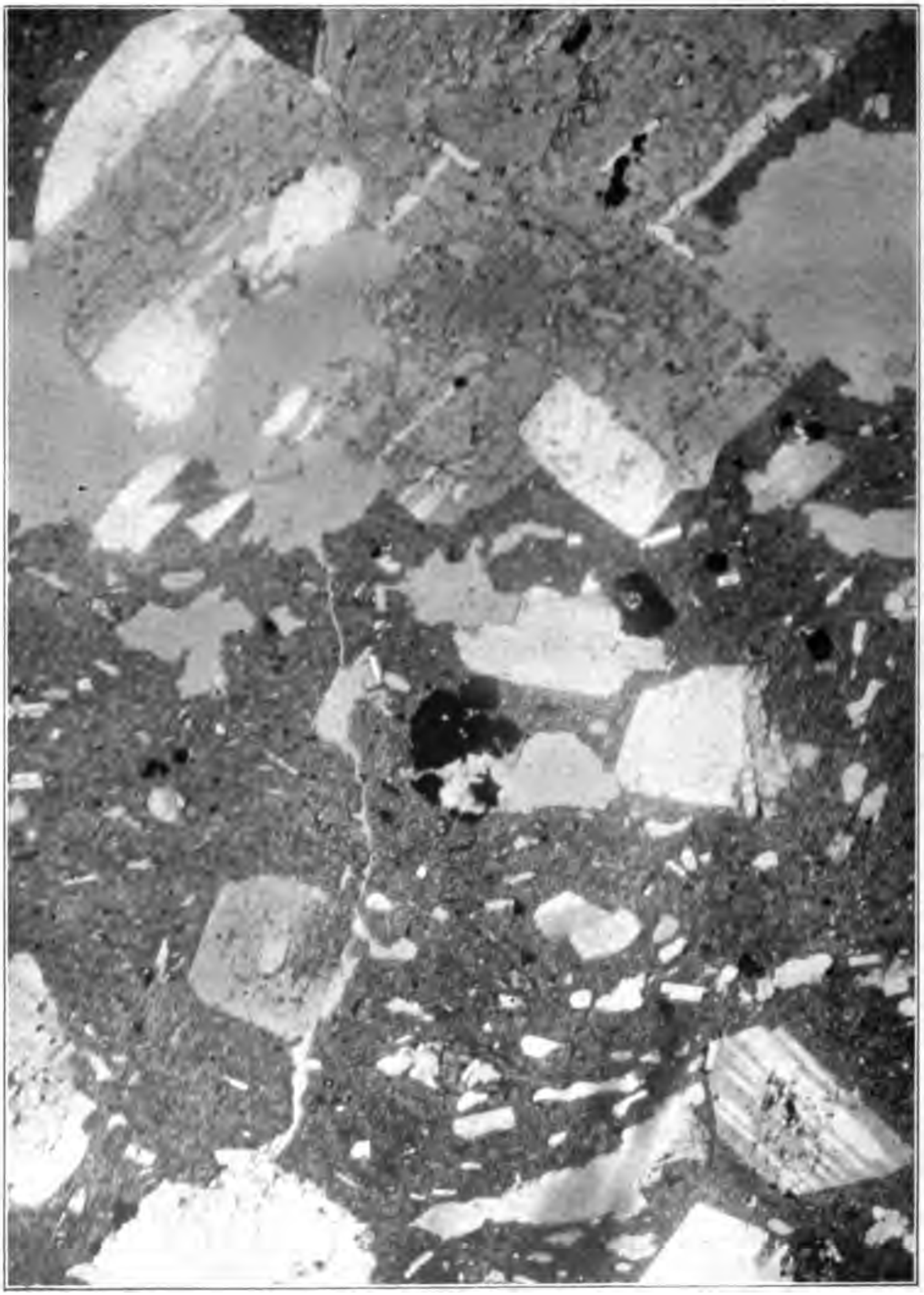
[*To face p. 162, Vol. II.*
i.



No. 420/4808. GLASSY HORNBLENDE ANDESITE.

[To face p. 162, Vol. II.

ii.



No. 421/4824. HYALOPILITIC HYPERSTHENE ANDESITE.

[*To face p. 163, Vol. II.*

No. 421/4824.

M.C.—Black porous volcanic rock, with white phenocrysts of plagioclase.

U.M.—MATRIX: Faintly brownish glass, crowded with felspar microliths, scattered magnetite grains, and pyroxene microliths, with flow-structure. Matrix more than half the rock.

PHENOCRYSTS.—*Plagioclase:* Crystals and fragments; *r.i.*, above balsam; ext., 24° (andesine-labradorite). Inclusions of brown glass, augite, and magnetite. Sometimes rich in inclusions.

Augite: Faint-green; sometimes twinned; sometimes ophitic, with plagioclase; some crystals are pleochroic. Inclusions magnetite, brownish ferric hydrate, and brown glass.

Hypersthene: Quite fresh, with characteristic pleochroism, and similar inclusions to those in the augite.

Porphyritic glomeruli of plagioclase, hyphersthene, augite, and magnetite are present.

Hyalopilitic Hypersthene Andesite.

Illustration.—Slice shows medium contrasts.

Photographed by polarised light, with nicols crossed no more than sufficient to give contrast on the screen; magnification, 33 diameters.

Locality.—Mangamaire Ridge, Kaimanawa Mountains, Wellington.

Formation.—Younger Pliocene or Pleistocene.

Remarks.—Found in a tuff formation of pumice and various volcanic rocks wind-carried from the north-west to the locality of the specimen.

No. 422/4829.

M.C.—Spherulitic rhyolite.

U.M.—MATRIX: Colourless glass densely charged with margarites and margaritic trichites, arranged in stream-lines, with a few sporadic negative microspherulites, and abundant large positive spherulites now weathered into finely granular material which is brown or opaque to transmitted and white to reflected light; in some places it becomes a fine granular quartz mosaic.

PHENOCRYSTS.—*Plagioclase:* Sometimes highly zonal; *r.i.*, above balsam; ext., 21° (andesine).

Pyroxene: A greenish augite, with the pleochroism of hypersthene; ext., 44°.

Magnetite: A few scattered grains.

Spherulitic and glassy flow-rock, containing andesine and augite.

Rhyolite, or Dacite Rhyolite.

Illustration.—Slice shows strong contrasts.

Photographed by polarised light; magnification, 33 diameters.

Locality.—Upper Valley of the Ngaruroro River, Wellington Provincial District.

Formation.—Younger Pliocene or Pleistocene.

Remarks.— Obtained from the river-bed, the great bulk of the shingle in which is formed of Palæozoic sandstones. However, high terraces bound the river-bed and low river-flats, and these are formed almost exclusively of pumice gravels, and contain masses of pumice up to 2 ft. in diameter, none of which are likely native to the watershed within which they are found (the far sources of the river have not been explored) but which have been projected from volcanoes on the opposite north-west side of the water-parting between the Waikato and the rivers running to the east coast.

No. 423/4834.

M.C.—Rhyolitic tuff.

U.M.—Matrix: Granular, isotropic, filled with shreds of glass (like broken contorted flow-lines), and splinters of felspar. The glassy fibres often granular crystalline at the margins.

Phenocrysts.—*Plagioclase* is the commonest felspar in well-formed simple crystals, clusters, and compound crystals and fragments. It is often highly zonal; *r.i.*, above balsam; ext., 11° / 14°, and is therefore andesite.

Sanadine is present in glassy clear corroded crystals.

Hypersthene, in broken crystals, showing the usual pleochroism, is not uncommon; it may include a little magnetite.

Quartz is fairly common in broken grains.

Magnetite is present.

Zircons occur occasionally.

Rhyolitic Tuff, containing andesine and hypersthene.

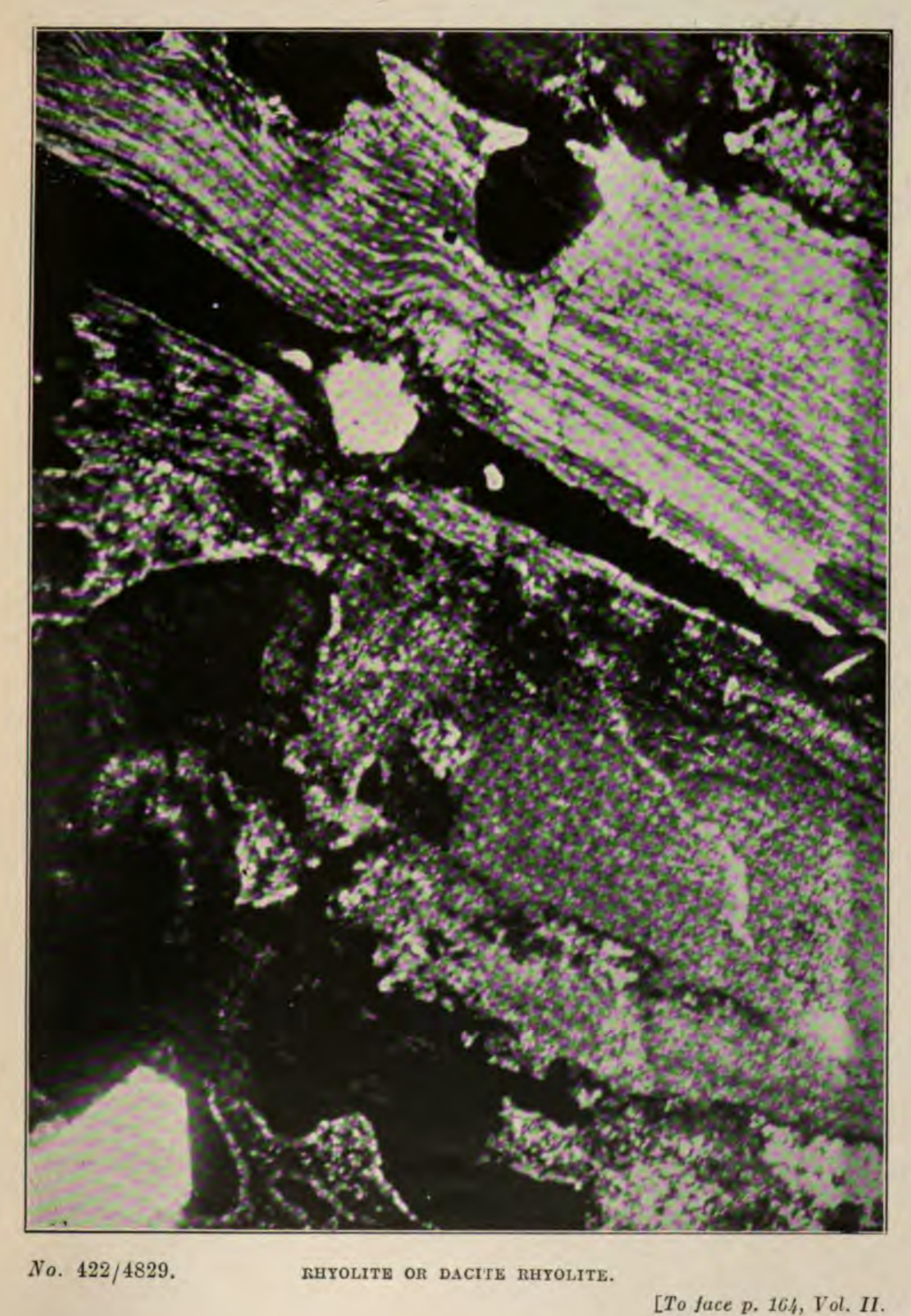
Locality.—Source of the Mangamaire Stream, Kaimanawa Mountains, Wellington.

Formation.—Younger Pliocene or Pleistocene.

Remarks.—From an isolated patch of trachytic or rhyolite rock lying to the east of the main watershed of this part of the North Island. This rock, though of a fragmental character, is solid and compact compared with the loose wind-borne material of a like nature or largely consisting of pumice found over most of this part of Wellington District and the east part of Hawke's Bay.

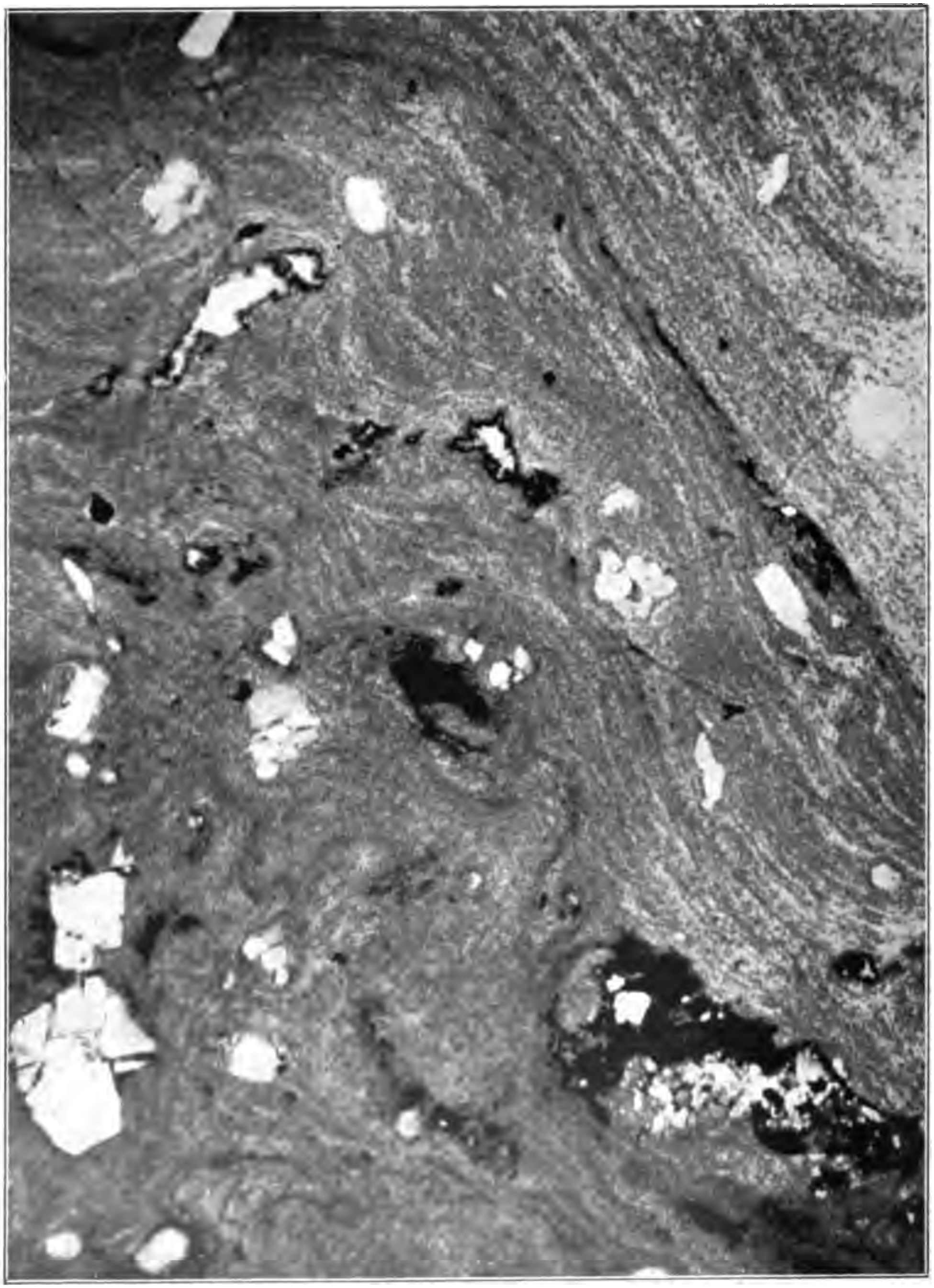
No. 424/4937.

M.C.—Andesic pitchstone, black, with white felspar crystals, stream-lines, and spherulites.



No. 422/4829. RHYOLITE OR DACITE RHYOLITE.

[*To face p. 164, Vol. II.*



No. 424/4937. ANDESIC PITCHSTONE. [*To face p. 165, Vol. II.*

M.C.—MATRIX: A colourless glass densely charged with margarites and belonites in contorted flow-lines, and scattered magnetite grains; occasionally dark-brown and granular, with small crystals in place of crystallites; sometimes fibrous microfelsitic.

A few minute fragments of included andesite are present. They consist of small plagioclase prisms, augite grains, and magnetite, and are without phenocrysts.

PHENOCRYSTS. — *Plagioclase :* Andesine–labradorite in small crystals and fragments; ext., 23°/23°; sometimes zonal.

Hypherſthene : A rare crystal or so, with the usual pleochroism.

Magnetite : An occasional large grain.

The rock fuses before the blowpipe to a colourless glass full of bubbles.

Andesic Pitchstone.

Illustration.—Slice shows medium contrasts.

Photographed by polarised light; magnification, 33 diameters.

Locality.—Mangamaire Ridge, Kaimanawa Mountains, Wellington.

Formation.—Younger Pliocene or Pleistocene.

Remarks.— The specimen is from a pumiceous deposit on the top of a mountain-ridge nearly 4,000 ft. above the sea. This and similar deposits in the neighbouring mountains that are at all flat-topped have resulted due to volcanic explosions, the material from which air-borne has accumulated to a depth of many feet in the positions indicated.

No. 425/4839.

M.C.—Dark-grey flow-rock, with phenocrysts of felspar.

U.M.—MATRIX: Porous, with rounded cavities; colourless and glass-like by ordinary light, with minute brownish granules and numerous belonites and margarites in obvious stream-lines; between *x.n.* resolved for the greater part into minute negative microspherulites, with a residuum of isotropic glass.

PHENOCRYSTS.—*Plagioclase :* Well-formed glassy clear crystals; *r.i.*, above balsam; extinction generally low, but sometimes reaches 29° (andesine–labradorite); abundant, of small size, often in clusters, also in fragments. Some large crystals are present, some of which are zonal. Inclusions glass, needles of apatite and magnetite.

Pyroxene : Green augite, not abundant, includes apatite and magnetite.

Magnetite : Several large grains.

Zircon : A few crystals are present.

Glassy Microspherulitic Andesite.

Locality.—Mangamaire Ridge, Kaimanawa Mountains, Wellington.
Formation.—Newer Pliocene or Pleistocene.
Remarks.—From the pumice-deposit that covers all the flat tops of the mountains of this particular part of the Wellington Provincial District. The source of this pumice-deposit lies towards the north and west, and at some considerable distance. the pumice, &c., being air-borne to the position where now found.

No. 426/4851.

M.C.—Dark-grey flow-rock, with crystals of white felspar.

U.M.—Matrix: Brownish and granular, charged with dark rod-like crystallites, and streaks of clear, colourless material with magnetite grains and marked flow-structure. Between *x.n.* the clearer streaks prove to be micropœcillitic quartz grains and quartz globularic; the much more abundant brownish material is finely fibrous microspherulitic with negative sign.

Phenocrysts. - *Plagioclase: R.i.,* above balsam; similar to that in No. 4839.

Augite: Small well-formed crystals sparingly scattered.

Hypersthene: Large crystals, with the usual pleochroism; associated with plagioclase, and enclose magnetite, apatite, and zircon.

Magnetite: A fair number of large grains; some include *zircon.*

Microspherulitic Andesite.

Locality.—Mangamaire Ridge, Kaimanawa Mountains, Wellington.
Formation.—Younger Pliocene or Pleistocene.
Remarks.—This specimen is from the pumice-deposit that covers all the flat-topped mountains of this part of the Wellington District.

No. 427/4789.

M.C.—Fine-grained granite.

U.M.—Holocrystalline granitic structure.

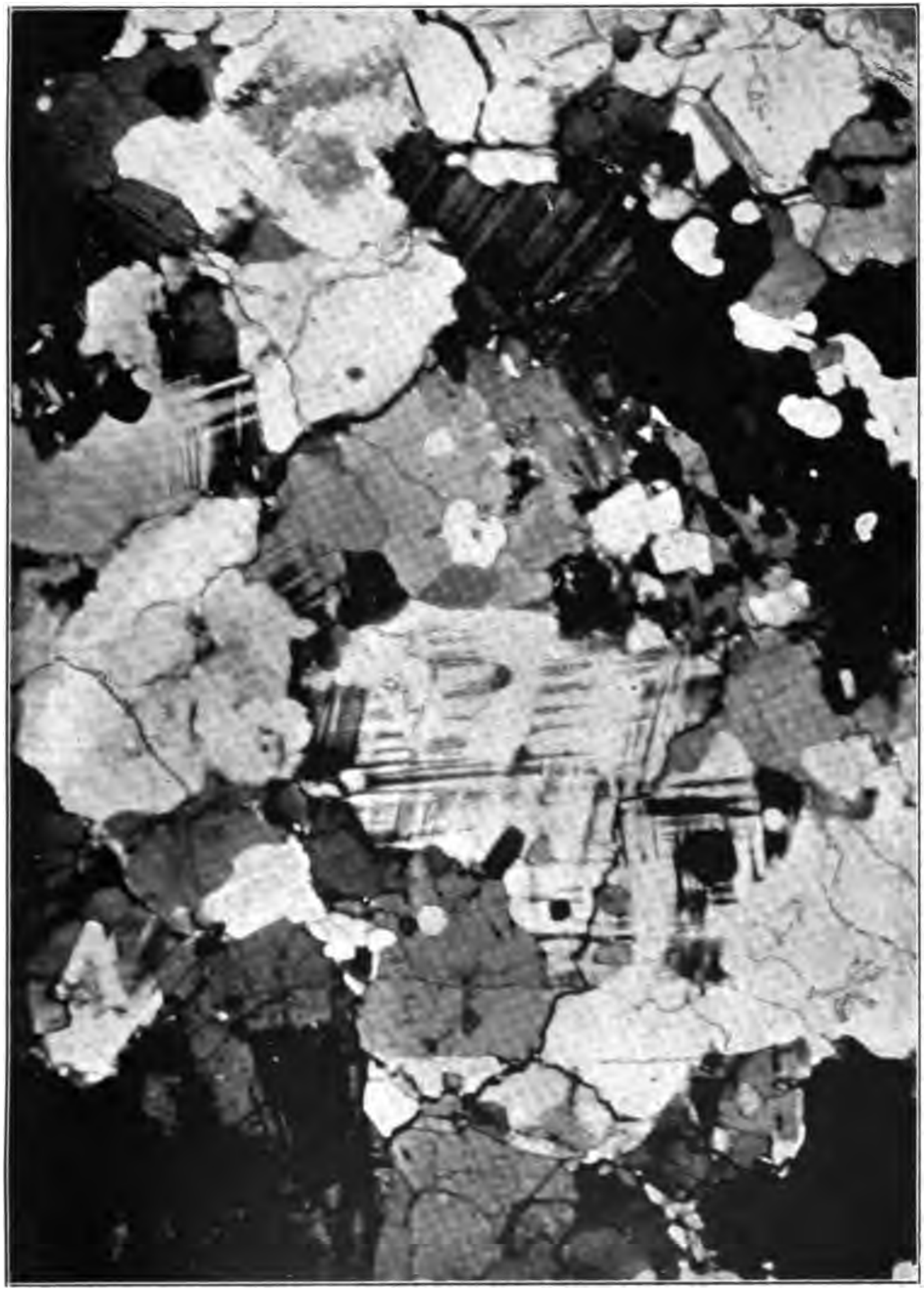
Plagioclase: Plagioclase mostly with *r.i.* above quartz, but sometimes below; extinguishes from 0° to 16°; probably a series from albite to andesine. It is somewhat hypidiomorphic, sometimes partly defined by quartz; sometimes it includes quartz. A zonal structure is sometimes present.

Microline is abundant; probably equal in quantity to the plagioclase. It includes quartz, and sometimes is micropegmatitic.

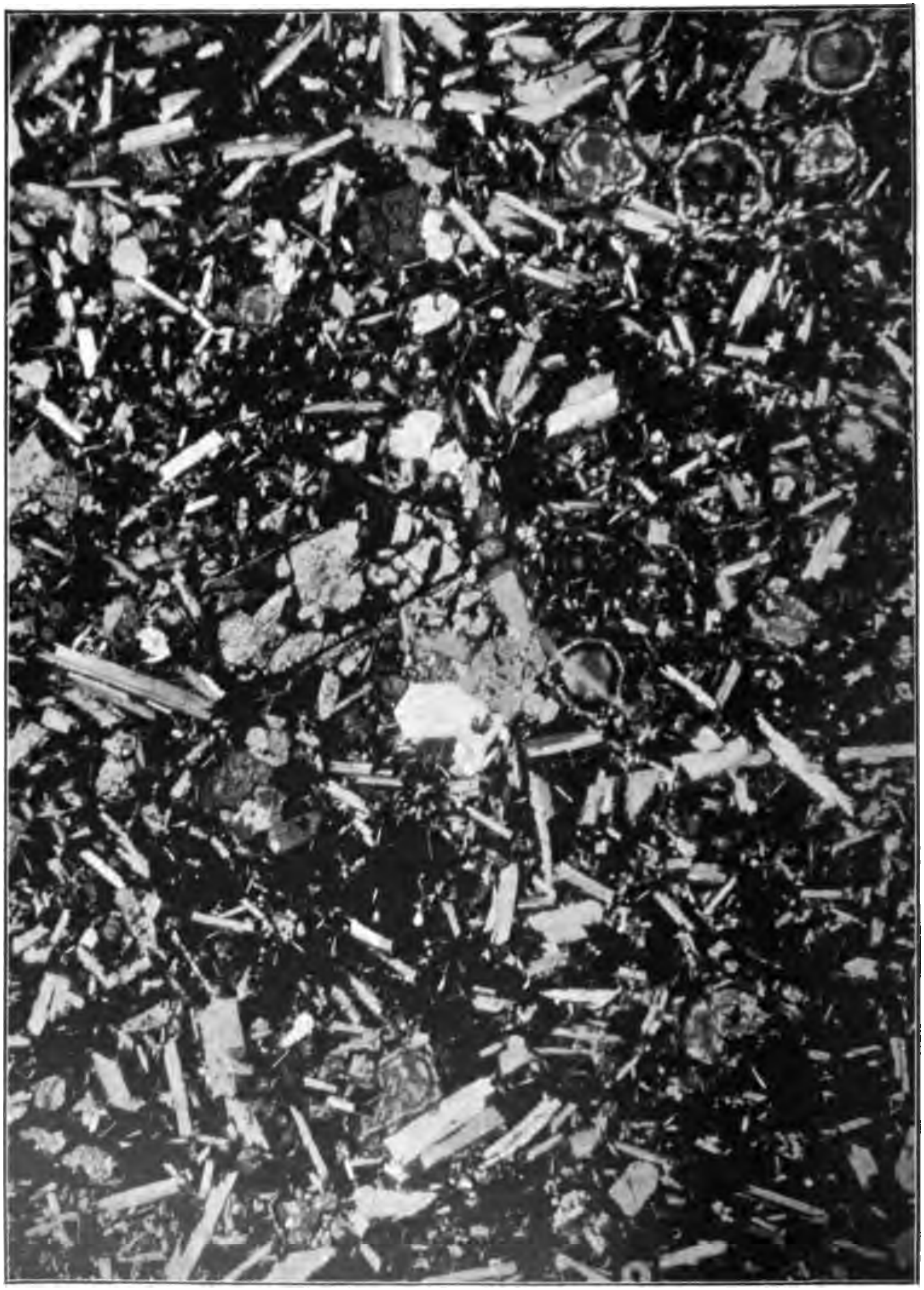
Muscovite is present in small quantity; sometimes partly included in olive-green biotite, sometimes in felspar.

Biotite: Straw-yellow / dark bronze-green, in corroded flakes, with inclusions of *apatite* and *sphene*; not abundant.

Granite.



No. 427/4789. GRANITE. [*To face p.* 166, *Vol. II.*



No. 428/4998.

BASALT.

[*To face p. 167, Vol. II.*

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters.

Locality.—Preservation Inlet, west coast of Otago.

Formation.—Intrusive; possibly Carboniferous.

Remarks.—As an intrusive mass this granite shows a breadth of two to three miles, and is flanked to the north by intensely crystalline schists, and to the south by Silurian rock much altered near the contact, but at some distance from it retaining impressions of graptolites.

No. 428/4998.

M.C.—Black basaltic-looking rock speckled with rusty-brown spots.

U.M.—MATRIX: Skeleton crystals of magnetite, felspar laths, and augite prisms with a tendency to radiate growth, and a trace of residual glass.

PHENOCRYSTS. —*Plagioclase:* Chiefly in plank-like sections with irregular terminations; ext., 27° (labradorite); includes augite. Labradorite is the predominant phenocryst.

Augite: Faint - brownish, almost colourless, fresh, and fairly abundant crystals; ext., 42°.

Olivine: In fairly numerous, large, well-formed crystals sometimes corroded by the matrix, often closely associated with augite: sometimes transformed into calcite, green serpentine, and ferric hydrate. Vesicles numerous, rounded; lined or filled with green serpentine, colourless serpentine sometimes filling the central part.

Basalt.

Illustration.—Though the phenocrysts are small, the slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; the part photographed may be considered as characteristic of the whole slice, but was selected on account of the greater number of vesicles filled with green or colourless serpentine.

Locality.—The Mason River, opposite the west spur of Mount Cookson, Amuri district, Nelson.

Formation.—Lower Miocene or Eocene.

Remarks.—From agglomerate tuffs and perhaps solid floes of basalt at the base of the Tertiary rocks of the district.

No. 429/4999.

M.C.—A brecciated igneous rock cemented together by carbonates.

U.M.—MATRIX: Clear yellowish-brown glass, without crystallites; in one fragment dark-brown excretions occur in the glass.

PHENOCRYSTS. —*Plagioclase:* Abundant rather small plank-like sections with stepped or irregular ends; ext., 28° / 28° (andesine–labradorite). Contains indications of brown glass.

Augite: Numerous faintly green crystals; ext., 42°.

Olivine: Large fresh colourless crystals somewhat corroded by matrix, sometimes beginning to change to dark-green serpentine.

Vesicles rounded, sometimes elongated; lined by orange-red palagonite, filled with radio-fibrous green serpentine, and surrounded by an aureole of dark granular glass.

Cracks of the breccia filled by a calcite mosaic having a radio-fibrous structure. The margins of the basaltic fragments are bordered orange-red palagonite, and within this by dark granular glass.

Brecciated Highly Glassy Basalt.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; the negative taken from this slice is a remarkably fine one, covering a 10 in. by 8 in. plate, a portion only of which has been reproduced in the illustration.

Locality.—Mason River, opposite the western slopes of Mount Cookson, Amuri district, Nelson.

Formation.—Lower Miocene.

Remarks.—In the locality of the specimen thick beds of limestone are superimposed, or have been on brecciated volcanic rocks or tuffs; and by filtration the rents in and spaces between the volcanic rocks have been filled with calcite, thus forming a solid rock.

No. 430/5001.

M.C.—Black basaltic-looking rock, with large phenocrysts of felspar, augite, and yellow olivine.

U.M.—MATRIX: Plagioclase laths, augite grains and prisms, and abundant magnetite granules.

PHENOCRYSTS.—*Plagioclase:* Large crystals, composite growths and fragments, with abundant inclusions of matrix; ext., 22° (andesine–labradorite).

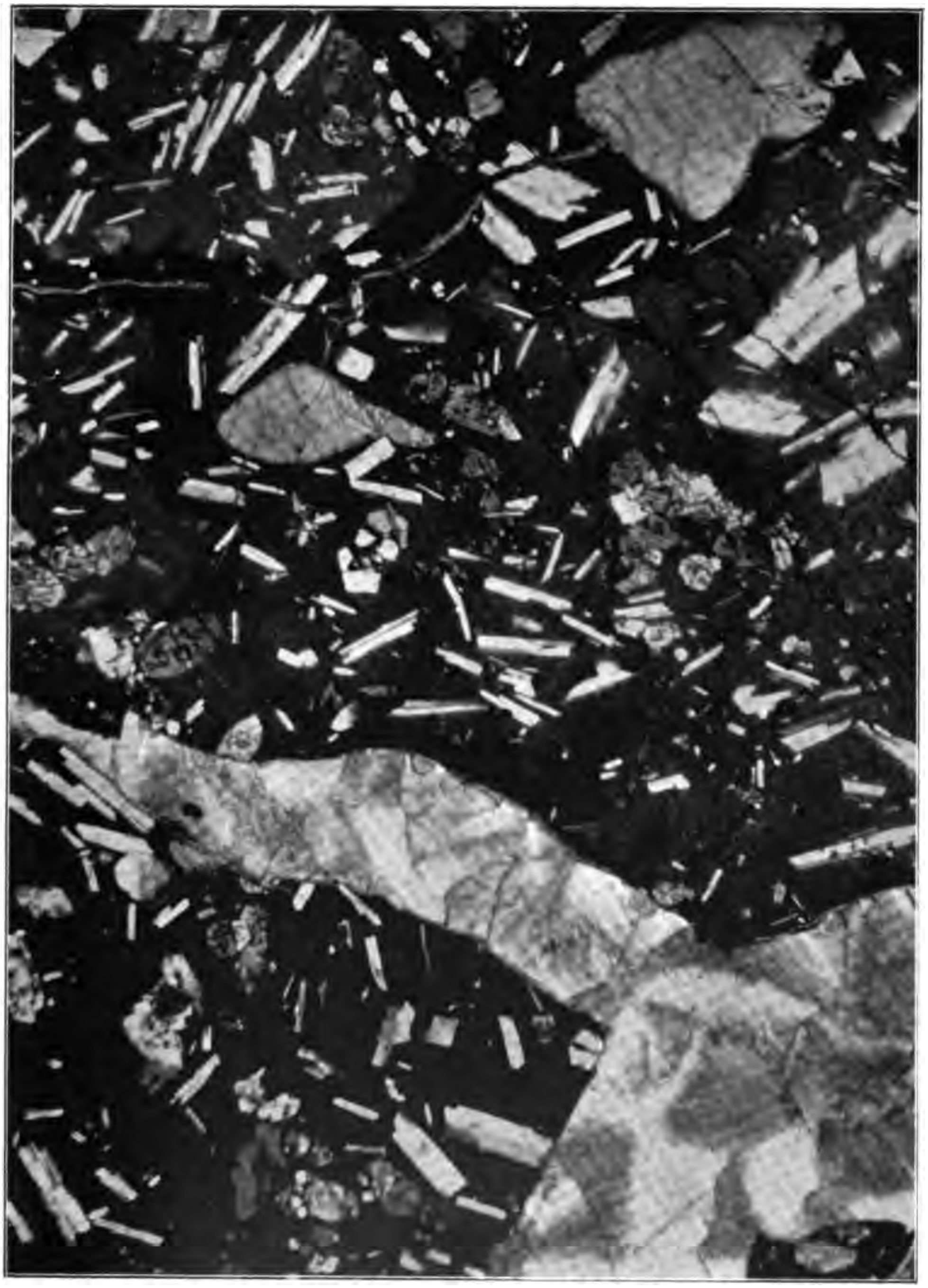
Augite: Numerous violet-brown crystals, faintly pleochroic, sometimes large; patchy and sometimes zonal extinction, with a tendency to have glass structure; ext., 44°. Magnetite and sometimes apatite included.

Olivine: A fragment of a large colourless crystal beginning to pass into serpentine along irregular cracks. A large pseudomorph in serpentine also observed in the slice.

Magnetite and perhaps *ilmenite* in numerous large grains, sometimes including apatite.

Basalt.

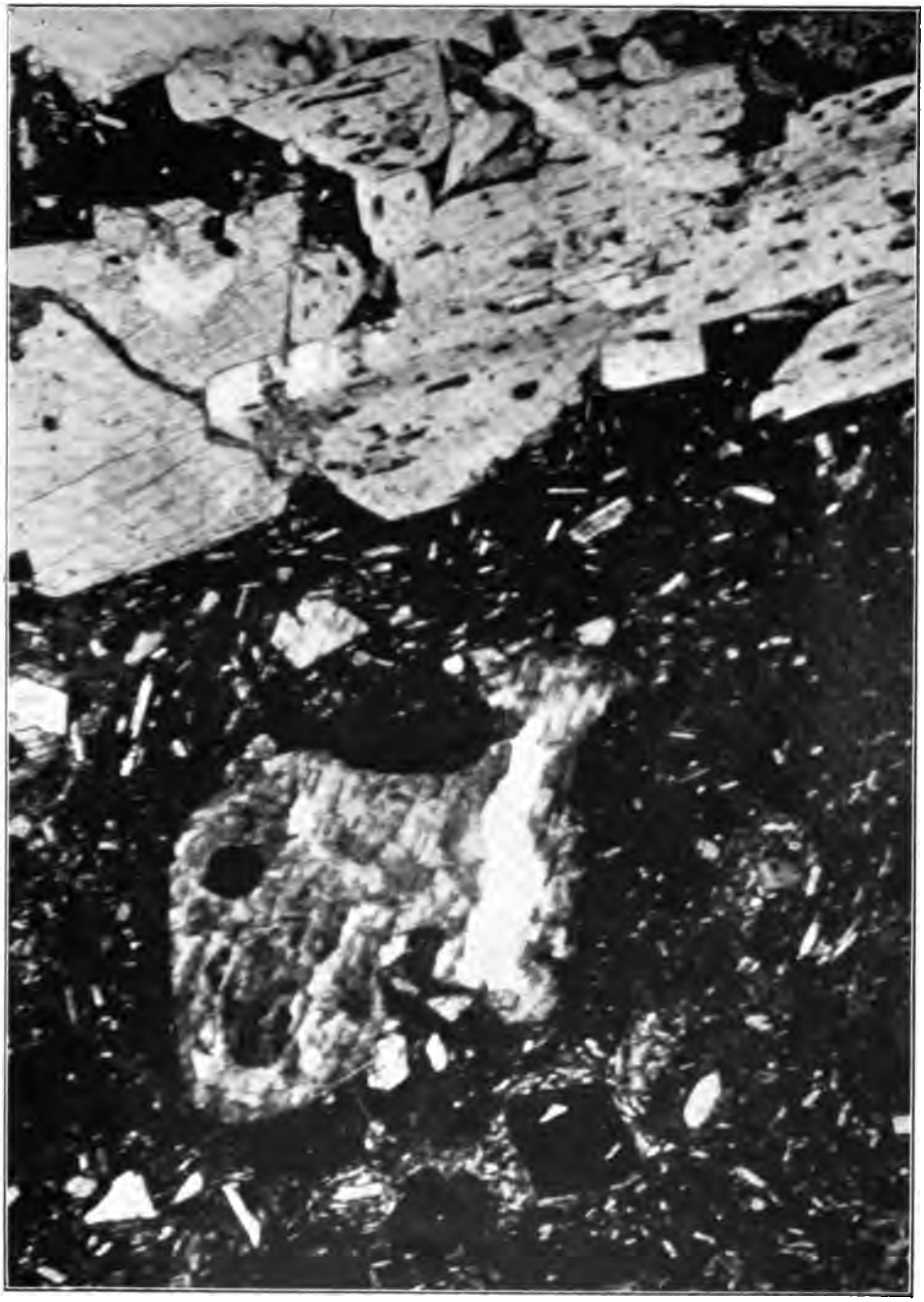
Illustration.—Slice is very unequal, but shows strong contrasts in the part photographed.



No. 429/4999. BRECCIATED HIGHLY GLASSY BASALT.

[To face p. 168, Vol. II.

i.



No. 430/5001. **BASALT.**

[To face p. 168, Vol. II.
ii.

Photographed by polarised light; magnification, 33 diameters.

Locality.—The Four Gates, Leader Valley, Amuri district, Nelson.

Formation.—Miocene or Upper Eocene.

Remarks.—The specimen was taken from the river-bed, and has probably been derived from Mount Cookson, as similar rocks underlie limestones forming the mass of Mount Cookson.

No. 431/5008.

M.C.—Pebble of rhyolite.

U.M.—MATRIX: Polarising in minutely granular fashion, varying in fineness of grain; contains shreds of altered flow-structure or pumice, patches of partly mosaicised positive spherulitic material, and some magnetite grains undergoing oxidation.

PHENOCRYSTS.—*Plagioclase:* Ext., 18°/20°.

Orthoclase is also present.

Both felspars are present in crystals and fragments, both are dusty, and the orthoclase is invaded by quartz.

Quartz: In abundant corroded crystals and fragments.

Partly **Silicified Rhyolite or Rhyolite Tuff,** containing some plagioclase.

Locality.—Coast Range, Cheviot Hills, Nelson.

Formation.—Carboniferous. Maitai series.

Remarks.—The specimen formed part of a conglomerate which was examined and collected from subsequent to the examination of Cape Colville Peninsula and the discovery of rhyolite and other igneous deposits of a volcanic character in the range between Coromandel and Manaia Harbours, and for the purposes of comparison with these the Cheviot rocks were collected, sliced, and described. In making such a comparison it has to be remembered that the Cape Colville Peninsula or Coromandel conglomerates are for the most part pebble-beds, in which the pellets are so small that many appear in the same slice, while the Cheviot conglomerate is much coarser and all the slices were obtained from individual boulders.

No. 432/5009.

M.C.—Fairly coarse granite, with conspicuous felspar and biotite.

U.M.—*Orthoclase:* In large grains, not fresh, frequently kaolinised or micacised.

Plagioclase: In large grains, close twinning; ext., 10°; none has a specific gravity above 2·65, mostly 2·62, consequently albite or albite / oligoclase. It is more abundant than orthoclase.

Quartz: In the usual mosaics.

Biotite: Abundant, pleochroism straw-yellow / clear deep-brown.

Muscovite : Comparatively rare.

Zircon occasionally present in the biotite, also *apatite* and *sphene.*

Granite.

Illustration.—Slice shows moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; the nicols were crossed not more than sufficient to give the necessary strength to the negative.

Locality.—Cheviot Hills, Nelson.

Formation.—Carboniferous. Maitai series.

Remarks.—The specimen formed part of a thick bed of conglomerate outcropping on the east slope of the range. Except sandstones all the rocks of this conglomerate appear to be foreign to the district in which they are found, and the whence of the granite here is not easily determined, but it may be assumed that when the material of this conglomerate was accumulated there was not of necessity mountain barriers interposed between the Cheviot Hills and the granite areas of the west of Nelson; even this, however, will not account for the presence of fluidal rhyolites in these conglomerates, as such rocks have not elsewhere been discovered in the northern part of the South Island.

No. 433/5010.

M.C.—Pebble of banded rhyolite.

U.M.—MATRIX: An irregular patchwork of impure quartz mosaic and minutely granular polarising material, with scattered minute scales of chlorite; in some places radio-fibrous spherulitic structure now consisting chiefly of quartz.

PHENOCRYSTS.—*Plagioclase:* Rare irregularly grown crystals, not fresh, contain chlorite; ext., 10°.

Quartz grains absent.

Silicified Rhyolite, containing plagioclase.

Locality.—Cheviot Coast Range, Cheviot Hills, Nelson.

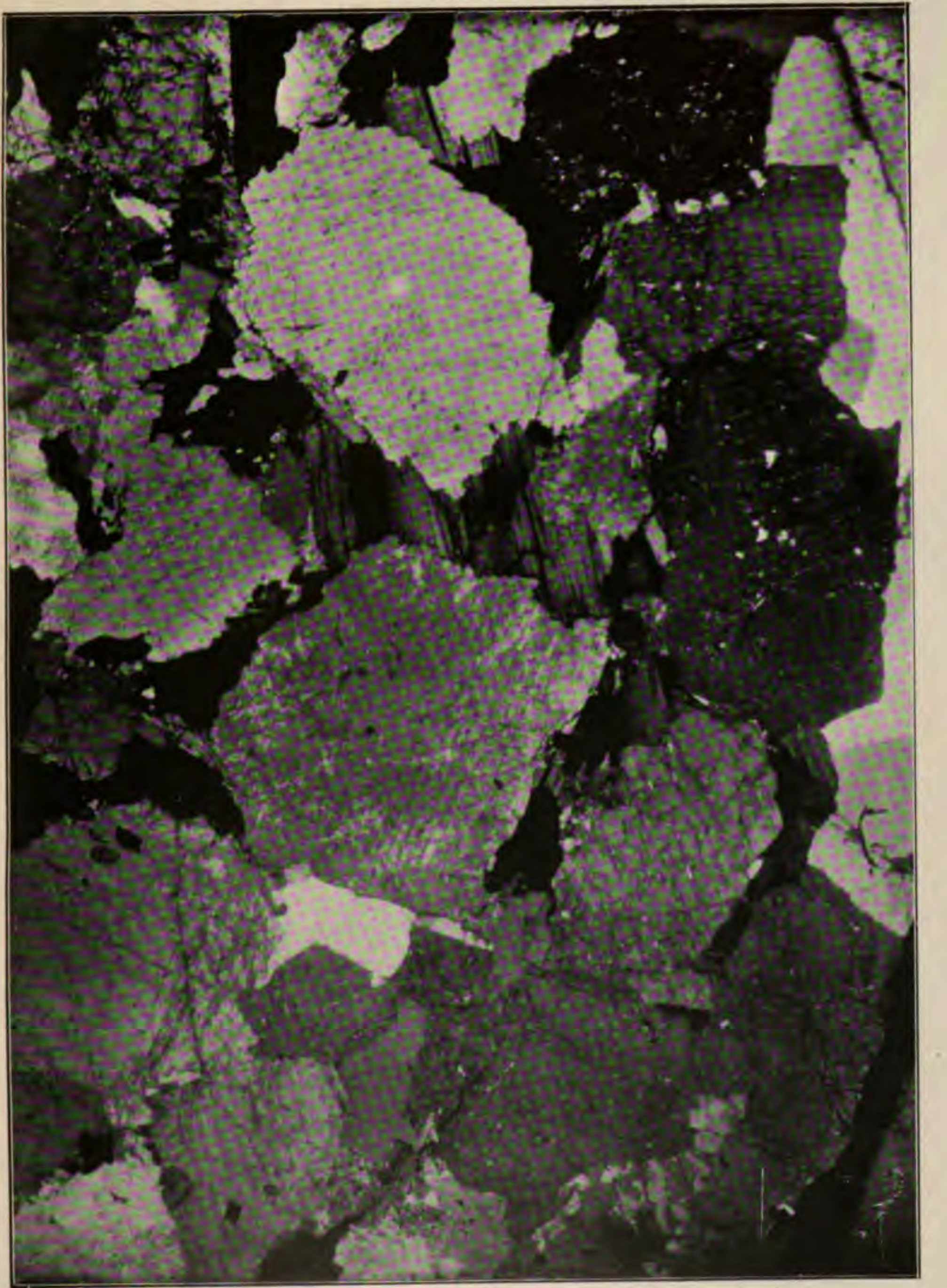
Formation.—Carboniferous. Maitai series.

Remarks.—From a thick bed of conglomerate occurring in the locality named.

No. 434/5011.

M.C.—Pebble of violet-grey compact rock, with crystals of white felspar and fragments of pumice(?).

U.M.—MATRIX: Dusty, with opaque granules; obvious flow-lines; polarises in minutely granular fashion or in irregular quartz mosaics. Some of the mosaics distinguished by an arrangement of the opaque granules in radial lines, pointing to original spherulitic structure.



No. 432/5009. GRANITE. [*To face p. 170, Vol. II.*

PHENOCRYSTS. — *Orthoclase* and *plagioclase:* Abundant fragments and crystals, clouded with white decomposition products and with marked rectangular lattice structure; *r.i.* of the plagioclase below balsam; ext., 8° (albite—oligoclase).

Pseudomorphs in chlorite, probably after *pyroxene,* not very common. Greyish leucoxene after *ilmenite*, with associated *zircons* and *apatite*.

Rhyolite, with plagioclase, and without quartz grains.

Locality.—Coast Range, Cheviot Hills, Nelson.
Formation.—Carboniferous. Maitai series.
Remarks.—From a thick bed of conglomerate in the locality named.

No. 435/5012.

M.C.—Pebble of igneous rock having an earthy fracture.

U.M.—MATRIX: Colourless, strewn with magnetite dust and pyrites, the latter often in small rounded granular aggregates, and with leucoxene. Between *x.n.* minutely granular, quartzose, with parallel straw-like lines representing felspar laths fluidly disposed. In places the quartz forms a mosaic; it is not clear, but charged with granules, chlorite possibly.

PHENOCRYSTS.—*Orthoclase* and *plagioclase:* Granular, altered, in large well-formed crystals; chlorite and epidote are associated alteration products.

No corroded quartz grains are present, and only the rarest traces of ferro-magnesian minerals.

Rhyolite, or Quartz Felsite(?), perhaps **Dacite.**

Locality.—Coast Range, Cheviot Hills, Nelson.
Formation.—Carboniferous. Maitai series.
Remarks.—The specimen formed part of a conglomerate about 40 ft. thick, which occurs on the east slope of the coast range, and contains a variety of different rocks, mostly igneous or metamorphic, but sandstones also occur. The material of this conglomerate must have been brought from a considerable distance if it came from the west or south; possibly it has been derived from land to the eastward that once existed beyond the present coast-line, and there are reasons for believing that from such land this conglomerate has reached the position in which it is now found.

No. 436/5013.

M.C.—Dark-grey felsitic-looking rock, porphyritic with felspar.

U.M.—MATRIX: Very patchy, most of it polarising in minute granules; minute scales of biotite are scattered through it and opaque white dust.

Some of the patches are included fragments, such as andesite with micropœcillitic groundmass and felspar laths in flow-lines. Pyroxene is represented by pseudomorphs.

PHENOCRYSTS.—*Orthoclase* and *plagioclase* (andesine): In well-formed crystals and fragments; some show micropegmatic intergrowth of quartz and felspar.

Quartz is abundant in much corroded grains.

Leucoxene after ilmenite is fairly common.

Rhyolite, containing fragments of altered andesite.

Locality.—Coast Range, Cheviot Hills, Nelson.

Formation.—Carboniferous. Maitai series.

Remarks.—The specimen above described formed part of a thick band of conglomerate on the east slope of the range.

No. 437/5016.

M.C.—Dark-grey rhyolite, porphyritic with felspar.

U.M.—MATRIX: Colourless, dusty with opaque white granules; streaked with flow-lines, which are distinguished by their poverty in granules. Between *x.n.* minutely granular, coarser over the flow-streaks. Sometimes passing into an obvious irregular quartz mosaic with included felspar laths.

PHENOCRYSTS.—*Orthoclase:* Corroded crystals and fragments.

Plagioclase: Finely twinned crystals and fragments; *r.i.*, below balsam; ext., 5°/5° (oligoclase); includes chlorite and mica scales.

Pyroxene: Characteristic transverse sections transformed into chlorite, with yellow / green pleochroism. Includes sphene after titaniferous magnetite. Some of these pseudomorphs are marked by a resorption border, suggesting hornblende.

Magnetite: Scattered decomposing grains.

Rhyolite, without quartz grains, but including plagioclase and pseudomorphs of pyroxene.

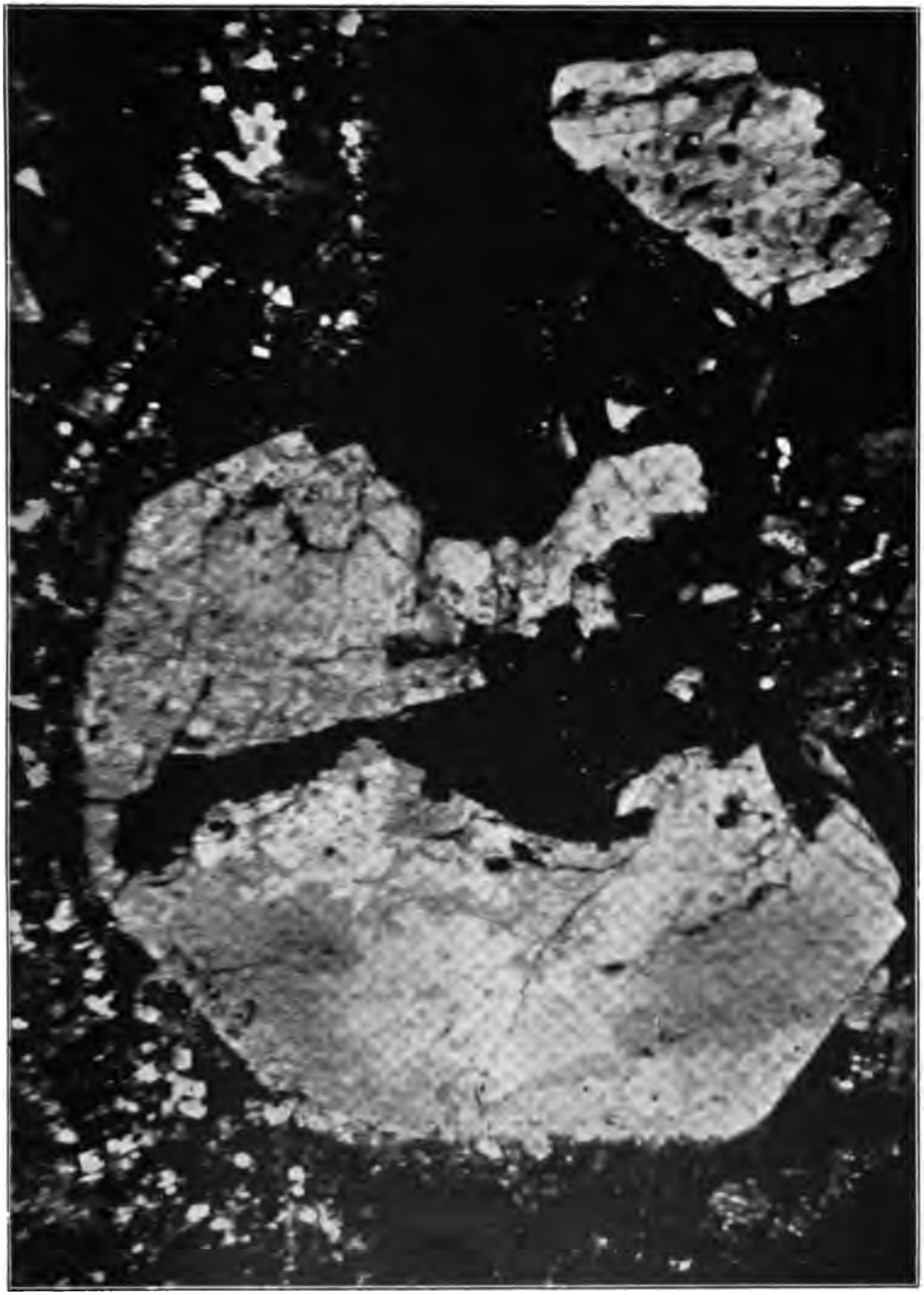
Illustration.—Slice shows fair contrasts.

Photographed by polarised light; magnification, 33 diameters; one large crystal was selected as the principal object in the photograph, and this has been retained in the centre of the area of the reproduction.

Locality.—Coast Range, Cheviot Hills, Nelson.

Formation.—Carboniferous. Maitai series.

Remarks.—The specimen is from the thick band of conglomerate that has been described as occurring on the east slope of the Cheviot Coast Range.



No. 437/5016. RHYOLITE.

[*To face p. 172, Vol. II.*

No. 438/5017.

M.C.—Dark fine-grained rock, with a granular fracture.

U.M.—*Quartzite:* Chiefly composed of grains of quartz, generally without other inclusions than liquid and vapour cavities, which are very minute, and sometimes arranged in lines, but occasionally rutile needles are present. Extinction frequently undulose, the result of pressure. The margins of the grains are defined in ordinary light by scales of chlorite; with polarised light they are sometimes seen within the margin, indicating a subsequent deposit of quartz upon the original grains.

Orthoclase probably present.

Plagioclase certainly occurs, but not to a greater extent than, say, one or two per cent. of the rock. The *r.i.* of the plagioclase is about that of quartz, sometimes above, sometimes below it, and is ext. 10° / 15°.

Fragments of microperthite, the quartz in threads, are present, but very rare; muscovite flakes are scanty; large rounded crystals of *zircon* not infrequent; grains of pyrites are scattered sparingly.

Quartzite—a consolidated sandstone, such as might have resulted from the denudation of a granite country.

Locality.—Coast Range, Cheviot Hills, Nelson.
Formation.—Carboniferous. Maitai series.
Remarks.—From a thick bed of conglomerate in the locality named. It is seldom that a rock so fine in grain occurs in this conglomerate.

No. 439/5021.

M.C.—Pebble of grey-green felsite-like rock.

U.M.—MATRIX: Positive spherulites and interstitial quartz.

PHENOCRYSTS.—*Microperthic orthoclase:* In large crystals, turbid.

Quartz: Fairly numerous, large and corroded grains.

Pyrites: Scattered grains; ferro-magnesian minerals represented by ragged patches of chlorite.

Rhyolite.

Locality.—Coast Range, Cheviot Hills, Nelson.
Formation.—Carboniferous. Maitai series.
Remarks.—From a thick bed of conglomerate outcropping on the east side of the range.

No. 440/4854.

M.C.—Coarsely crystallized gabbro-like rock.

U.M.—MATRIX: None; holocrystalline.

PHENOCRYSTS.—*Plagioclase:* In large grains, never fresh, banded with chlorite, sometimes with colourless serpentine. In one case *r.i.* below balsam; ext., 14°, in another, in which the *r.i.* is not determinable, 15° / 30°, probably oligoclase and andesine. Some grains traversed by veinlets of colourless serpentine containing actinolite needles.

Hornblende: In large grains, scarcely pleochroic, brownish. The colour is discharged in patches, and the mineral is passing into colourless decomposition product; in places it becomes asbestiform. The double refraction is weak; ext., 15°. It contains a good deal of sphene and some altered ilmenite.

Quartz occurs rarely as an interstitial mineral, and then shows the effects of pressure. It is also included in some of the amphiboles.

Hornblende Plagioclase Rock, very possibly a transformed dolerite or gabbro.

Locality.—Gorge of the Waipaoa River, Poverty Bay, Auckland.
Formation.—Lower Miocene or Eocene.
Remarks.—The specimen is a sample from a coarse breccia conglomerate that for the most part is composed of rocks that do not otherwise occur in the district. Granite in a like geological horizon has been reported from other parts of the North Island within which no true granite nor any metamorphic rock *in situ* has yet been discovered.

No. 441/4857.

M.C.—Irregular nodule of indurated greensand.

U.M.—Is seen to consist of grains of glauconite, irregular fragments of quartz and occasionally of felspar, cemented by opaque material and reddish-brown ferric hydrate.

The glauconite grains are composed of a confused aggregate of glauconite scales, with minute vermiform clear interspaces. They do not contain any coccoliths, foraminifera, or other organic remains, thus differing from those described by me from the Cambridge greensands.

The ferric hydrate also occurs in isolated scales and ball-like aggregates within the greensand grains, and projects from the margin inwards.

Indurated Greensand.

Locality.—Gorge of the Waipaoa, Poverty Bay, Auckland.
Formation.—Cretaceous.

Remarks.—The greensands underlie white chalky limestones, and in their softer parts probably constitute storage for petroleum, which occurs in the district. Where the specimen was collected the greensands are more indurated than is commonly the case, and have attracted attention for a long time past. Samples have been analysed under the belief, by the collector, that the rock was a copper-ore. No copper, but silver, it is said, was found. The description above affords an explanation as to how such report may have arisen.

No. 442/4858.

M.C.—A pebble of dark fine-grained crystalline rock.

U.M.—The structure is doleritic.

Plagioclase occurs in long plank-like sections penetrated by ferro-magnesian minerals. It is irregularly scattered, with a tendency to radiate grouping; the twinning is frequently irregular, and the twinning planes bent. The *r.i.* is above balsam, and the extinction 21° (andesine–labradorite).

Augite: Colourless (in the slice); abundant; ext., 40°. It is passing into green amphibole, with straw-yellow / green pleochroism; ext., 15°. In a vast number of cases the transformation is complete, but it can be traced through all stages from a slight alteration confined to the margin of an augite crystal up to complete change. The amphibole itself undergoes further alteration, breaking up into actinolite fibres which penetrate some of the plagioclase crystals.

Quartz and *pyrites* are present in small quantities, occurring most frequently in those places where actinolitisation occurs, and this is generally along lines of crush.

Altered Andesite, with doleritic structure; or it might be termed a **Diorite.**

Locality.—Gorge of the Waipaoa River, Poverty Bay, Auckland.
Formation.—Lower Miocene or Eocene.
Remarks.—The specimen is part of a boulder from a huge breccia conglomerate which, resting on Cretaceous rocks, extends many miles along the east flank of the main range of this part of the Auckland District.

No. 443/4860.

M.C.—Hornblende gneiss, or banded hornblende, augite, plagioclase rock.

U.M.—Holocrystalline, the mineral grains flattened in the direction of foliation, with evidence of having suffered from pressure.

Plagioclase: Clear, colourless; ext., 15°/ 20°; *r.i.*, above balsam (andesine). Broken and replaced in places; twinning planes bent and over certain areas obliterated.

Pyroxene: Abundant, faint bluish-green, omphacite-like in transverse sections, evidently pleochroic; straw-yellow / faint ferrous green; ext., 38°.

Hornblende: Almost as abundant as pyroxene, grass-green / olive-green / yellow.

Sphene: A fair quantity, almost colourless, sometimes forming a string of crystals running parallel with the banding.

Apatite: A few large colourless crystals.

Magnetite: A few grains.

Quartz: Occasional grains, with undulose extinction very difficult to distinguish from plagioclase, but do not possess cleavage.

Epidote: A few rare crystals.

Pyroxene Hornblende Gneiss.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; the original covered a 10 in. by 8 in. plate, but only a portion of this has been reproduced.

Locality.—Gorge of the Waipaoa River, Poverty Bay, Auckland.

Formation.—Lower Miocene or Eocene.

Remarks.—From a remarkable conglomerate mainly composed of crystalline and metamorphic rocks, but also including rocks of Cretaceous age—limestones and septarian concretions. These conglomerates rest on the Cretaceous rocks, and are also interstratified with the finer sediments of the Lower Tertiary beds of the district.

No. 444/4865.

M.C.—Dark violet-grey fine-grained basalt-like rock, with a few vesicles filled with calcite.

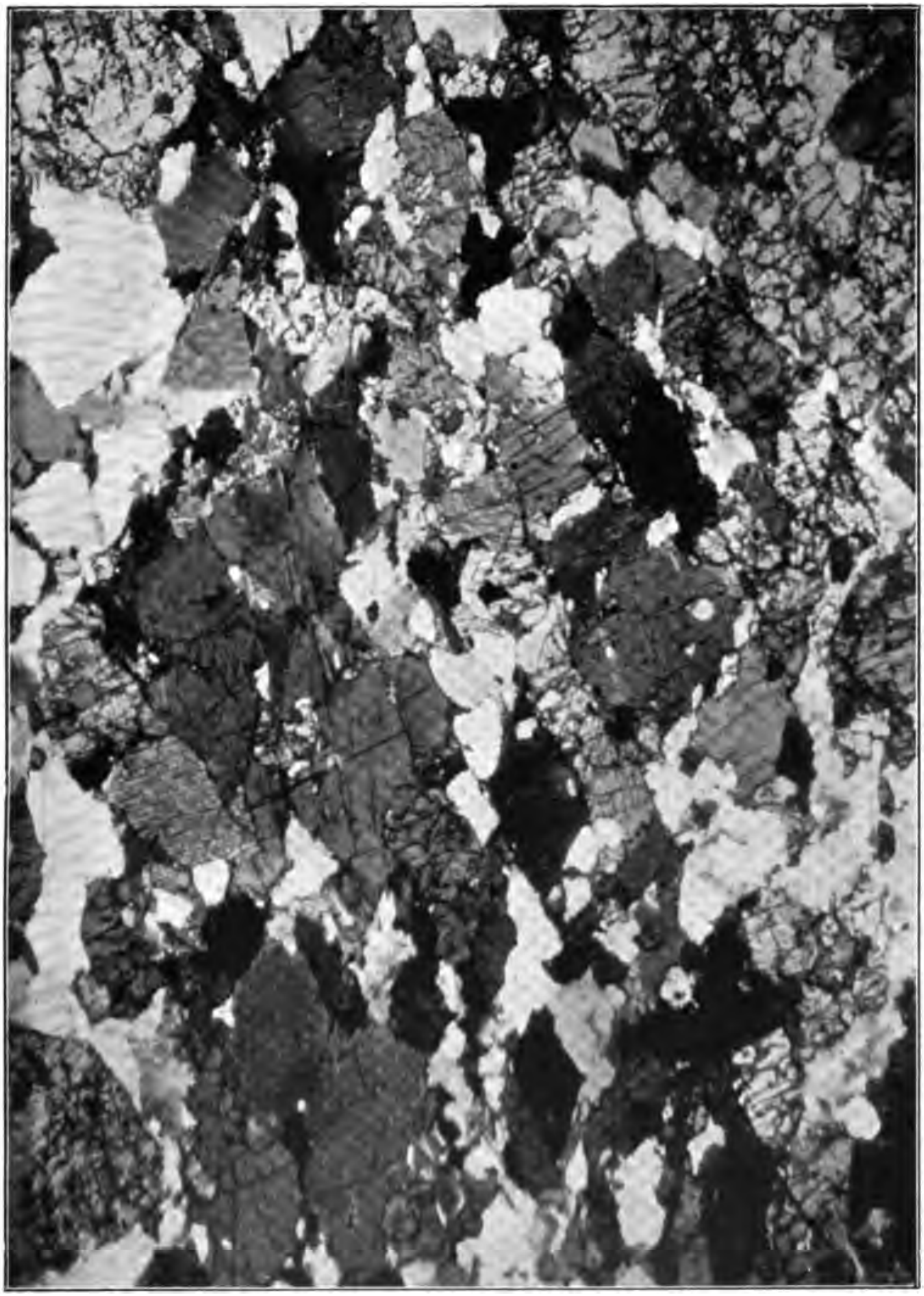
U.M.—MATRIX: Holocrystalline, forming nearly the whole rock. It consists of plagioclase frequently in ophitic plates, including the other constituents, such as augite in well-formed brownish crystals; ext., 39°; fairly pleochroic. Biotite in small scattered flakes, straw-yellow / russet - brown. Magnetite in abundant granules, and snow-white leucoxene after titaniferous magnetite, as well as green pleochroic alteration product after olivine.

PHENOCRYSTS.—All the foregoing minerals may occur as larger growths. The felspar shows a tendency to radiate forms.

The first mineral to consolidate was magnetite; olivine and augite followed (the latter shows zonal growth), and finally the plagioclase.

Vesicles: Some are filled with radio-fibrous felspar and associated biotite, and a colourless isotropic zeolite (analcime). One large vesicle is lined with this zeolite, and the infilling is completed by calcite.

Basalt, containing some biotite.



No. **443/4860.** PYROXENE HORNBLENDE GNEISS.

[*To face p. 176, Vol. II.*

Locality.—Gorge of the Waipaoa River, Poverty Bay, Auckland.

Formation.—Lower Miocene or Eocene.

Remarks.—Forms part of a coarse breccia conglomerate in the locality named, and thence extending along the Mata Valley to the south-east base of Hikurangi Mountain.

No. 445/4933.

M.C.—Banded hornblende rock.

U.M.—Holocrystalline; the chief constituent is hornblende grass-green / straw-yellow.

Pyroxene (augite) is not abundant, but occurs in faint bluish-green crystals, with feeble pleochroism; smaragdite-like.

Plagioclase and *quartz* are crushed together to form a dirty granular aggregate, elongated in the direction of banding.

Sphene and *apatite* are not uncommon.

Hornblende Gneiss, containing augite.

Locality.—Gorge of the Waipaoa River, Poverty Bay, Auckland.

Formation.—Lower Miocene or Eocene.

Remarks.—From a coarse breccia conglomerate resting unconformably on Cretaceous rocks in the East Cape district of Auckland. The rocks of this conglomerate are usually foreign to the district and derived from igneous or metamorphic areas, none of which are found in the East Cape district of Auckland, except at Cape Runaway, and there the igneous-rocks are not similar. With the igneous rocks is associated in the conglomerate masses of Amuri limestone and saurian concretions of Cretaceous age.

No. 446/5029.

M.C.—Fine-grained greenish-black obscurely foliated rock.

U.M.—*Plagioclase* grains much affected by pressure, twinning planes bent and obliterated, crystals crushed and granulated, zoisite and epidote sometimes included.

Augite: Faint-green abundant crystals, deformed, broken, and granulated at the margin; chloritised in places (the chlorite green / blue); double refraction low; ext., 44. Diallage-like twinning superinduced.

Hornblende: Large brownish crystals; ext., 21°; pleochroism straw-yellow / olive-brown / warmer brown.

Apatite: In large crystals.

Magnetite: As strings of the mineral.

Hornblende Augite Gneiss.

Illustration.—Slice shows but moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; the reproduction represents generally the character of the slice.

Locality.—Gorge of the Waipaoa River, Poverty Bay, Auckland.

Formation.—Lower Miocene or Eocene.

Remarks.—The specimen is from a coarse breccia conglomerate largely formed of igneous and metamorphic rocks not found *in situ* in this or any part of the North Island. Their origin is consequently obscure, and the speculation that the bulk of the material forming this conglomerate has been carried by ice from the Collingwood district of Nelson is tenable only for lack of a better explanation of the facts.

No. 447/4823.

M.C.—Pebble of light-grey volcanic rock.

U.M.—MATRIX: Colourless, but very dusty. Between *x.n.* minutely granular, with obvious lobate grains of quartz; and traces of micropœcillitic structure, scattered opaque granules, chlorite scales, and a little magnetite.

PHENOCRYSTS.—*Microperthite:* Numerous large broken crystals far from fresh, often full of calcite dust, sometimes corroded.

Quartz: In large jagged grains, not like rhyolite quartz.

Pyrites and *magnetite:* A few scattered grains. Ferro-magnesian minerals represented by calcite pseudomorphs.

Rhyolite, or Quartz Felsite.

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate in the locality named.

No. 448/4941.

M.C.—A crushed pebble of compact and banded felsite.

U.M.—MATRIX: Highly quartzose, micropœcillitic, with leucoxene in scattered dust or granular aggregates. Felspar laths in flow-lines.

PHENOCRYSTS.—*Plagioclase:* In occasional small crystals, and some dusty quartz mosaics which run in bands parallel to the stream-lines.

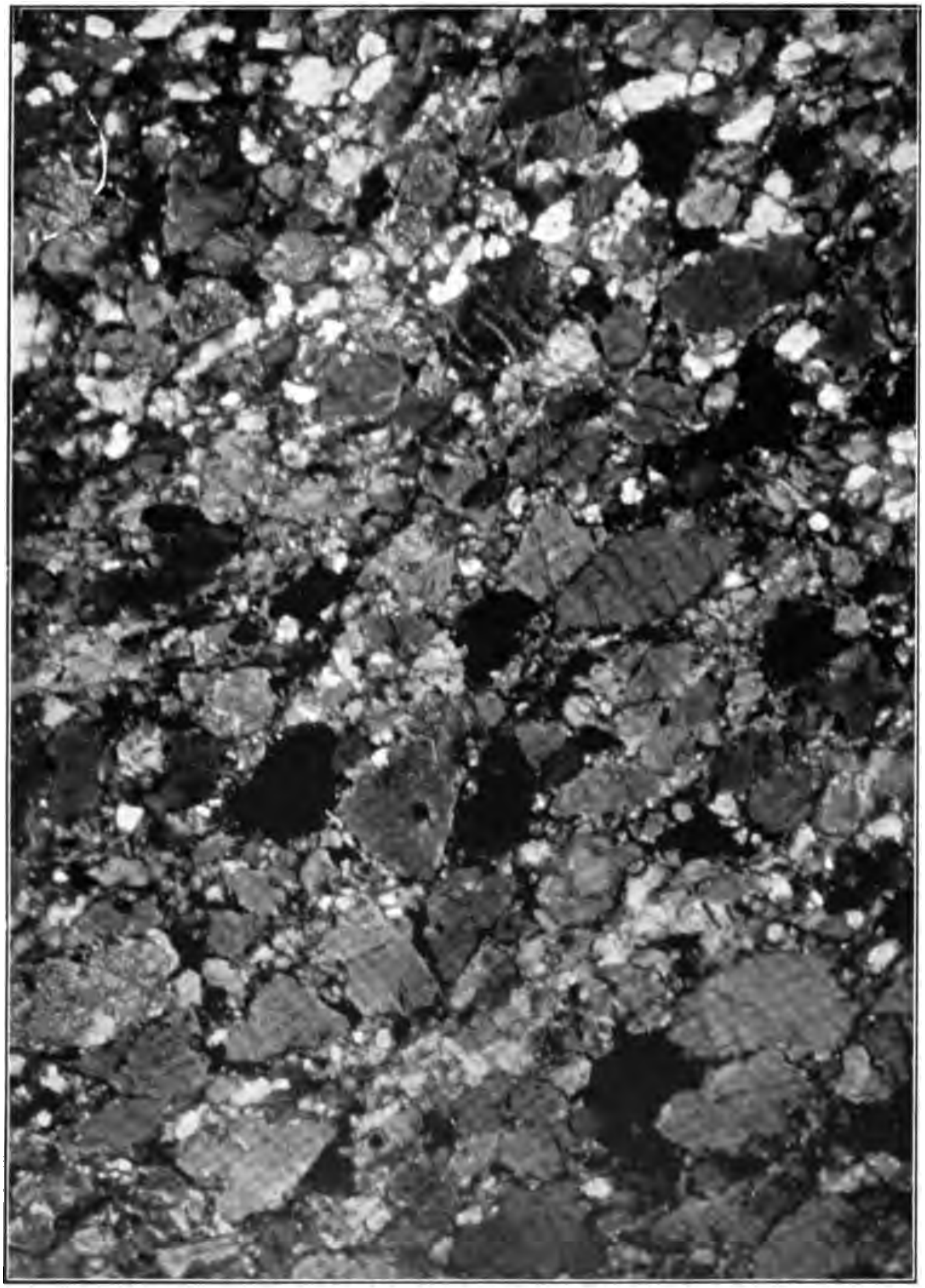
Epidote in isolated prisms and radiate growths sparingly present.

Quartz Felsite.

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—The specimen is from a thick bed of conglomerate in the locality named.



No. 446/5029. HORNBLENDE AUGITE GNEISS.

[To face p. 178, Vol. II.

No. 449/5030.

M.C.—Dark-grey rock, with very numerous crystals of quartz and white felspar.

U.M.—MATRIX: Colourless, with streaks of granular contorted flow-structure. Between *x.n.* minutely granular. Here and there fragments of spherulitic growth.

PHENOCRYSTS.—*Quartz:* In numerous large corroded grains.

Plagioclase: Chiefly in broken crystals and granular by alteration; ext., 18°; *r.i.*, below balsam (albite).

Orthoclase: Not frequent; intergrown with quartz.

Ferro-magnesian minerals, represented by pseudomorphs of chlorite, abundant.

Magnetite: A little.

Rhyolite, with albite.

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate, mostly of crystalline rocks, outcropping on the shore of the bay and on the adjacent spurs of the Hautotara Mountains.

No. 450/5031.

M.C.—A pebble of grey andesic-looking rock.

U.M.—MATRIX: Microspherulitic bands; micropœcillitic quartz mosaic bands, with felspar laths in flow-lines; and a few bands of clear quartz mosaic, leucoxene granules, and chlorite.

PHENOCRYSTS.—*Plagioclase:* In crystals, complexes, and fragments; dusty; ext., 19°; twinning planes close and thin.

Biotite: A few bleached and ragged remnants, with associated ilmenite and sphene.

Epidote: A few scattered grains.

Ilmenite: In altered nets. Quartz grains are absent.

Rhyolite, with plagioclase (? **Andesitic Rhyolite**).

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate chiefly of crystalline rocks that are prominent in the locality named.

No. 451/5032.

M.C.—Pebble, broken by earth-pressure, of a greenish volcanic rock.

U.M.—Matrix: Colourless, granular with leucoxene, minute chlorite flakes, and more sparingly epidote. Between *x.n.* micropœcillitic, with felspar laths in flow-lines; quartz sometimes crystallized in clearer grains with micropœcillitic borders.

Phenocrysts.—*Plagioclase:* Much epidotised, scattered sparingly.

Titaniferous *magnetite* represented by leucoxene.

Ferro-magnesian minerals rarely represented by pseudomorphs in chlorite and epidote, and sometimes quartz.

Fractures in the rock filled with calcite.

Altered Micropœcillitic Andesite.

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate chiefly of crystalline rocks that showing on the shore-line of the bay strike north-east along the higher part of the Hautotara Mountains.

No. 452/5072.

M.C.—Greyish-green altered rock, with traces of phenocrysts.

U.M.—Matrix: Between *x.n.* minutely granular; contains much leucoxene, richly scattered like the magnetite in a basic rock, and evidently representing transformed titaniferous magnetite. Abundant chlorite gives the rock its green colour; it represents an altered ferro-magnesian mineral, but much of it is without pseudomorphic outlines. Felspar laths are visible in some patches, and minute irregular lobate grains of quartz, with suggestions sometimes of micropœcillitic structure.

Phenocrysts.—*Plagioclase:* Chiefly in small and not numerous fragments; ext., 12°. Zenoliths of flow rocks, chiefly andesite, are abundant.

Probably an **Altered Andesite.**

Locality.—East side of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate chiefly of crystalline rocks in the locality named.

No. 453/5073.

M.C.—Brecciated pebble of greenish-grey compact rock.

U.M.—There are three constituents visible in the slice. (i.) Dark granular groundmass, between *x.n.* minutely granular, cryptocrystalline, almost isotropic; leucoxene; chlorite; colourless green and yellow epidote; quartz and traces of felspar can be recognised in it.

Phenocrysts are rare. A few small scattered fragments of felspar and chlorite pseudomorphs. Fractures filled with calcite.

(ii.) A clastic rock formed of quartz grains, altered plagioclase, and biotite. This penetrates and fills a crack in (i).

(iii.) Like (i), but clearer, coarser, and much altered groundmass, with clusters of leucoxene granules. Between *x.n.* minutely granular; epidote, ziosite, and chlorite abundant. A few circular areas about the size of negative microspherulites are present. They are occupied by a clearer quartz mosaic.

Clastic Rock mostly formed of alteration products.

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate in the locality named.

No. 454/5075.

M.C.—Brecciated pebble of hard grey rock.

U.M.—MATRIX: Patchy, abundant white granules and minute chlorite scales in colourless basis. Between *x.n.* finely granular, with felspar laths in flow-lines in some patches.

PHENOCRYSTS.—*Plagioclase:* Many small fragments; ext., 13°; *r.i.*, above balsam (oligoclase–andesine).

Orthoclase: (?).

Quartz grains and pyroxene pseudomorphs are absent. Fractures in the rock filled with calcite.

Altered Rhyolite, with plagioclase.

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate formed chiefly of crystalline rocks developed in the mountains of the south-east of Wellington.

No. 455/5077.

M.C.—Black compact rhyolite, with small crystals of felspar and quartz.

U.M.—Matrix: Dirty and patchy, showing flow-lines; between *x.n.* minutely granular, the granulation differing in fineness in different stream-lines. Some streams of obvious quartz.

Phenocrysts.—*Plagioclase*: Weathered crystals and fragments; ext., 20°; and of *orthoclase*, with characteristic cleavage and extinction.

Quartz: Fairly abundant, corroded grains, with pyrites occasionally present filling cracks.

Epidote: Rare, apparently replacing some ferro-magnesian mineral.

Biotite: A very little, and that chloritised.

Magnetite: Passing into pyrites.

Apatite: Some.

Altered Rhyolite, containing plagioclase.

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate occurring in and forming part of the Hautotara Mountains in the south-east district of Wellington.

No. 456/5081.

M.C.—Purple compact rock, with felspar phenocrysts. A crushed pebble.

U.M.—Matrix: Micrographic intergrowths of quartz and felspar, the latter in small well-defined prisms, in many cases orthoclase. Patches of calcite are disseminated. Small crystals of pyrites, abundant white opaque granules, and a little epidote are also scattered through the slice.

Phenocrysts.—*Microperthite* and *orthoclase*: In crystals and fragments and clusters, often corroded by the matrix, and dusty with decomposition products.

Titaniferous magnetite represented by leucoxene; and ferro-magnesian mineral by pseudomorphs in quartz.

Granophyre (of Rosenbusch).

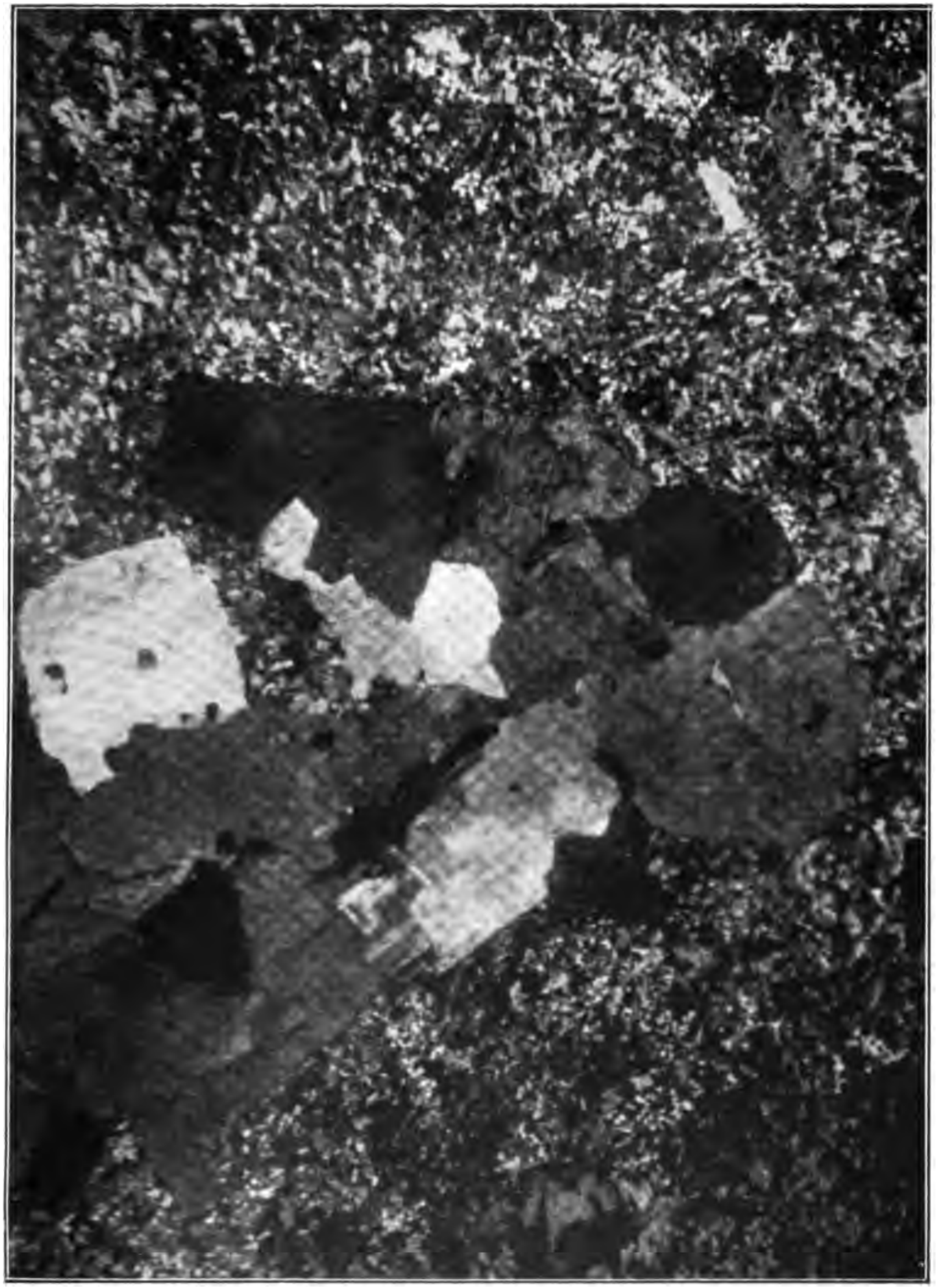
Illustration.—Slice shows but moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; the nicols were crossed only sufficiently to give on the screen the contrast required.

Locality.—East shore of Palliser Bay, Wellington.

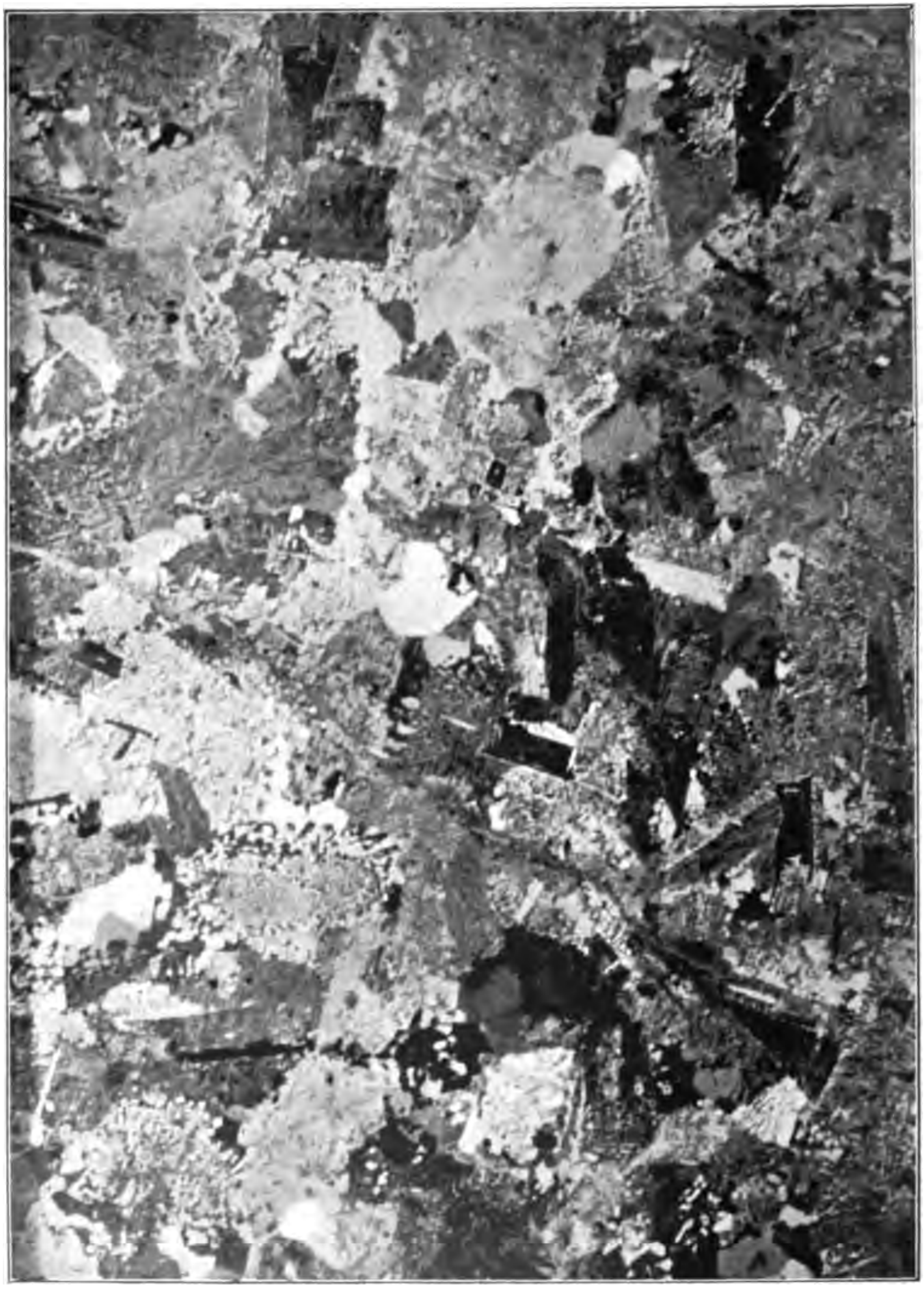
Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate in the locality named.



No. 456/5081. GRANOPHYRE.

[*To face p. 182, Vol. II.*



No. 458/5089. **QUARTZ FELSITE.**

[*To face p. 183, Vol. II.*

No. 457/5086.

M.C.—Light-grey felspathic-looking rock, with obvious bi-pyramids of quartz.

U.M.—MATRIX : Coarsely spherulitic and micropegmatic, with subordinate quartz mosaics.

PHENOCRYSTS.—*Plagioclase:* With a low angle of extinction, not fresh, charged with minute white granules. Its growth sometimes completed microperthite or orthoclase.

Orthoclase : Frequently as microperthite, in well-formed crystals, sometimes containing quartz micropegmatitically in the middle, more often with a very fine micropegmatitic margin passing into a micropegmatitic spherulitic structure.

Quartz : Abundant in corroded bi-pyramids and grains.

Calcite : Interstitial, sometimes radio-fibrous.

Spherulitic and Micropegmatitic Rhyolite, evidently a varietal form of No. 5089, which I called a **Quartz Felsite.**

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—The specimen is from a heavy band of conglomerate formed mainly of crystalline igneous and metamorphic rocks.

No. 458/5089.

M.C.—Light-grey felspathic rock, showing lustre mottling.

U.M.—Holocrystalline, composed of dusty *microperthitic felspar* in idiomorphic crystals, with a margin of micropegmatite ; ext., 27°; with microperthitic lines. *Quartz* mosaics occur here and there, but no corroded quartz grains. Interstitial *calcite* is present in small quantity ; a little green chlorite, probably after *biotite,* some *magnetite* grains, *sphene,* and an occasional *zircon* are present.

Quartz Felsite.

Illustration.—Slice does not show good contrasts.

Photographed by polarised light ; magnification, 33 diameters ; the reproduction is part only of the original 10 in. x 8 in. negative.

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—The specimen is from a conglomerate associated with fine-grained breccias, sandstones, and slates that form the Hautotara Mountains in the south-east of the Wellington Provincial District. These rocks are supposed to be at least of

Carboniferous age—in any case not younger than Trias nor older than Upper Devonian, and the conglomerates are identical with those from the Coast Range, Cheviot Hills, which are considered Carboniferous in age.

No. 459/5093.

M.C.—Banded rhyolite.

U.M.—Some bands show microspherulitic structure, replaced by an irregular granular quartz mosaic; the original spherical form and radio-fibrous structure is still visible in ordinary light.

These bands form most of the rock, but there are a few others in which traces of coarser spherulitic structure are indicated, suggesting the presence originally of positive spherulites; these now consist of quartz mosaic.

PHENOCRYSTS. — *Plagioclase:* In crystals, fragments, and clusters; not abundant; far from fresh.

Pseudomorphs in chlorite with associated sphene and apatite occur rarely.

Xenoliths rich in felspar laths in stream-lines resembling the groundmass of andesite are present.

This rock is much fractured and faulted; the cracks are filled with calcite.

Rhyolite, containing plagioclase.

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate mainly of crystalline rocks that occur in the locality named and form part of the neighbouring spurs of the Hautotara Mountains.

No. 460/5095.

M.C.—Grey granitic rock.

U.M.—*Plagioclase:* Abundant in idiomorphic or hypidiomorphic crystals; *r.i.*, below balsam; ext., 16°; specific gravity, 2·61 (albite, perhaps potash-holding); growth often completed by micropegmatite.

Orthoclase is rare, it may contribute to the micropegmatite.

Biotite: In chloritised flakes, straw-yellow / green, with associated sphene.

Muscovite: Very sparingly present.

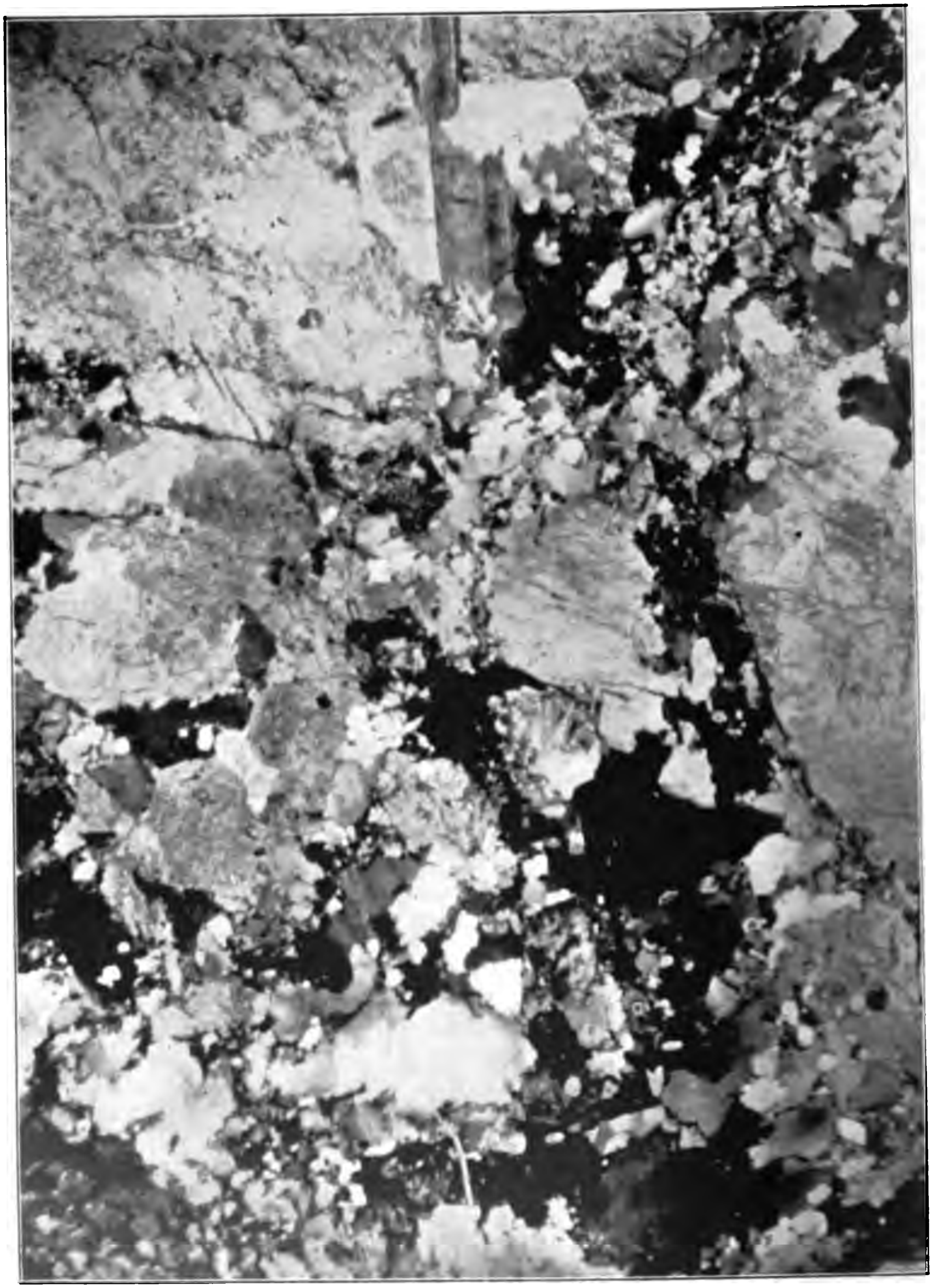
Epidote and *zoisite:* Fairly common, associated with chlorite.

Magnetite grains, altered or undergoing alteration.

Quartz: A few mosaics, but occurs chiefly as micropegmatite.

The absence or rarity of orthoclase is surprising, but is clearly shown both by the diffusion column and observations on the slice.

Micrographic Albite Granite, or Mica Diorite.



No. 461/5096. **FOLIATED GRANITE.**

[*To face p.* 185, *Vol. II.*

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate chiefly of crystalline rocks in the locality mentioned.

No. 461/5096.

M.C.—Greenish-white crystalline rock with obvious felspar.

U.M.—Holocrystalline. Abundant quartz mosaics, with arabesque or granular margins, the grains flattened in one direction; extinction frequently undulose.

PHENOCRYSTS. — *Plagioclase:* Less abundant than *microperthite,* twinning planes often bent. It occurs in smaller crystals than the microperthite.

Orthoclase (Microperthite): In large grains, granular with alteration products, sometimes contain included plagioclase crystals.

Biotite: A few fragmentary flakes, straw-yellow / red-brown. Sometimes chloritised *sphene* is associated with it.

Magnetite, apatite, and *zircons* are present in small quantity.

Calcite is scattered in small patches.

Foliated Granite.

Illustration.—Slice shows moderate contrasts.

Photographed by polarised light; magnification, 33 diameters; the reproduction is part only of the original photograph.

Locality.—East shore of Palliser Bay, Wellington.

Formation.—Carboniferous. Maitai series.

Remarks.—From a conglomerate of crystalline rocks forming part of the Hautotara Mountains in the south-east district of Wellington.

No. 462/1427.

M.C.—Greenish-grey serpentinous schist, with glide planes and "blatt" fractures; containing copper-pyrites and other sulphides.

U.M.—Colourless and faintly yellow serpentine, drawn out in line of movement; includes streaks and granules of copper-pyrites, but much of the rock consists of an open mosaic of colourless pyroxene, the interstices being filled with copper-pyrites, which is also disseminated through the pyroxene.

The pyroxene extinguishes at 39°, and in rare cases forms a core to surrounding colourless hornblende, which extinguishes at 19°. A little picotite may be present.

A serpentinised olivine pyroxene rock, containing copper-pyrites and other sulphides. The copper-pyrites looks as though it might have been an original constituent, but this can hardly be determined without field evidence. The rock has been subjected to earth-movement.

Serpentinised Olivine Pyroxene Rock.

Locality.—Dun Mountain mineral belt, Nelson.

Formation.—Upper Devonian. Te Anau series.

Remarks.—The olivine serpentine belt of the Dun Mountain Range is interposed between the lowest beds of the Maitai series (Lower Carboniferous) and the upper part of the Te Anau series (Upper Devonian), and is so disposed that it is difficult to say to which it should be referred. For the most part it has been referred to the older series.

No. 463/1482.

M.C —Rock consisting of mica, the flat scales lying more or less in foliation planes.

U.M.—Large hypidiomorphic crystals of *muscovite*, with smaller crystals of brown *biotite* in interstitial aggregates, mostly fresh, rarely chloritised; here and there a little *magnetite*. Both micas contain numerous small crystals of colourless *andalusite*, which sometimes attain a larger size; a little colourless *sphene*, minute irregular *quartz*, and an occasional *zircon*.

A somewhat foliated rock, consisting chiefly of muscovite.

Muscovite Rock.

Illustration.—Slice shows fair contrasts.

Photographed by polarised light; magnification, 33 diameters; the part photographed is characteristic of the whole of the slice.

Locality.—Range between Rocky Point and the gorge of the Taipo River, Teremakau Valley, Westland.

Formation.—Middle schists of Westland.

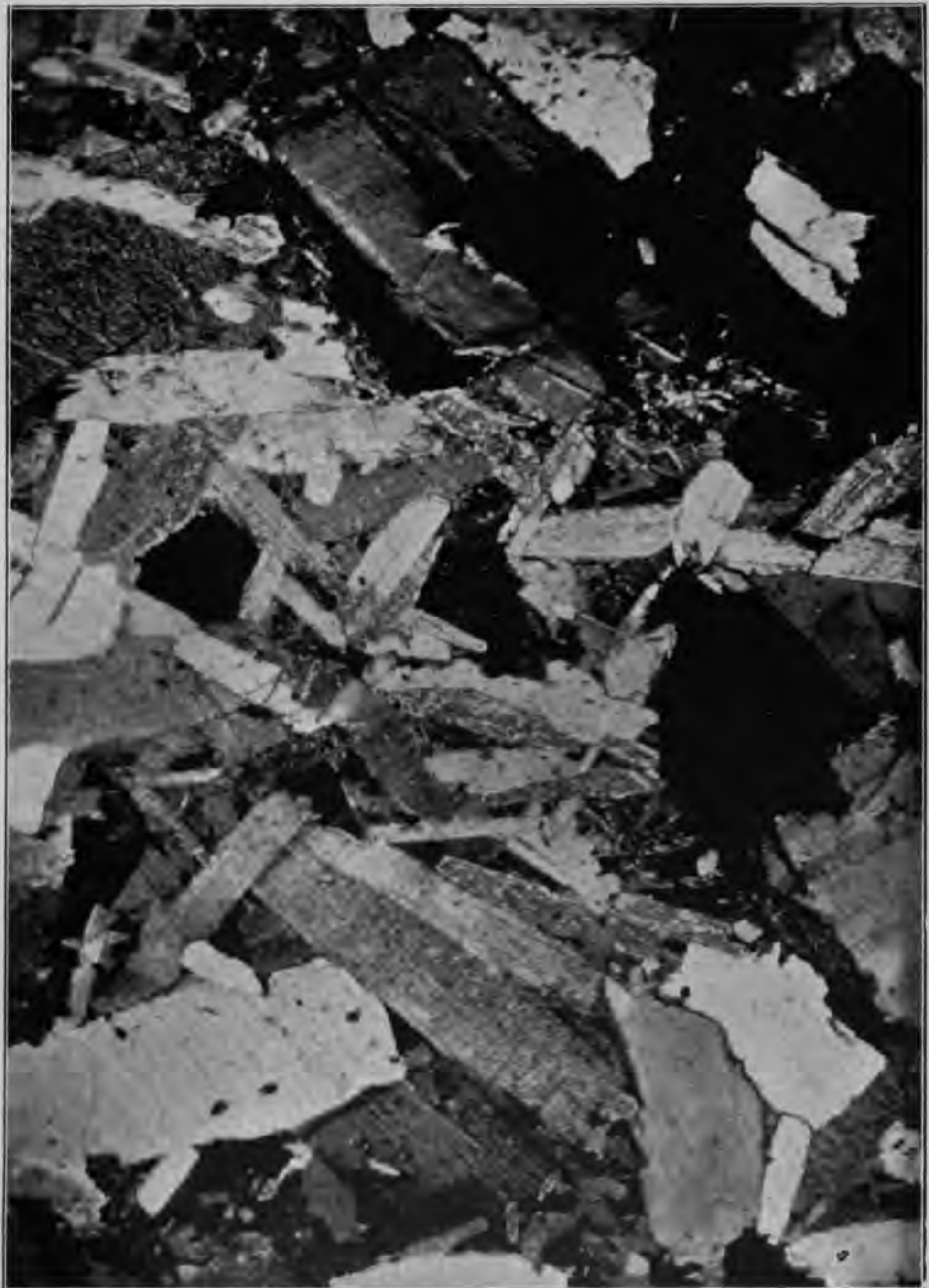
Remarks.—This rock occurs in considerable mass in connection with No. 1601.

No. 464 1486.

M.C.—Mica schist, wrinkled across the foliation planes (secondary folding).

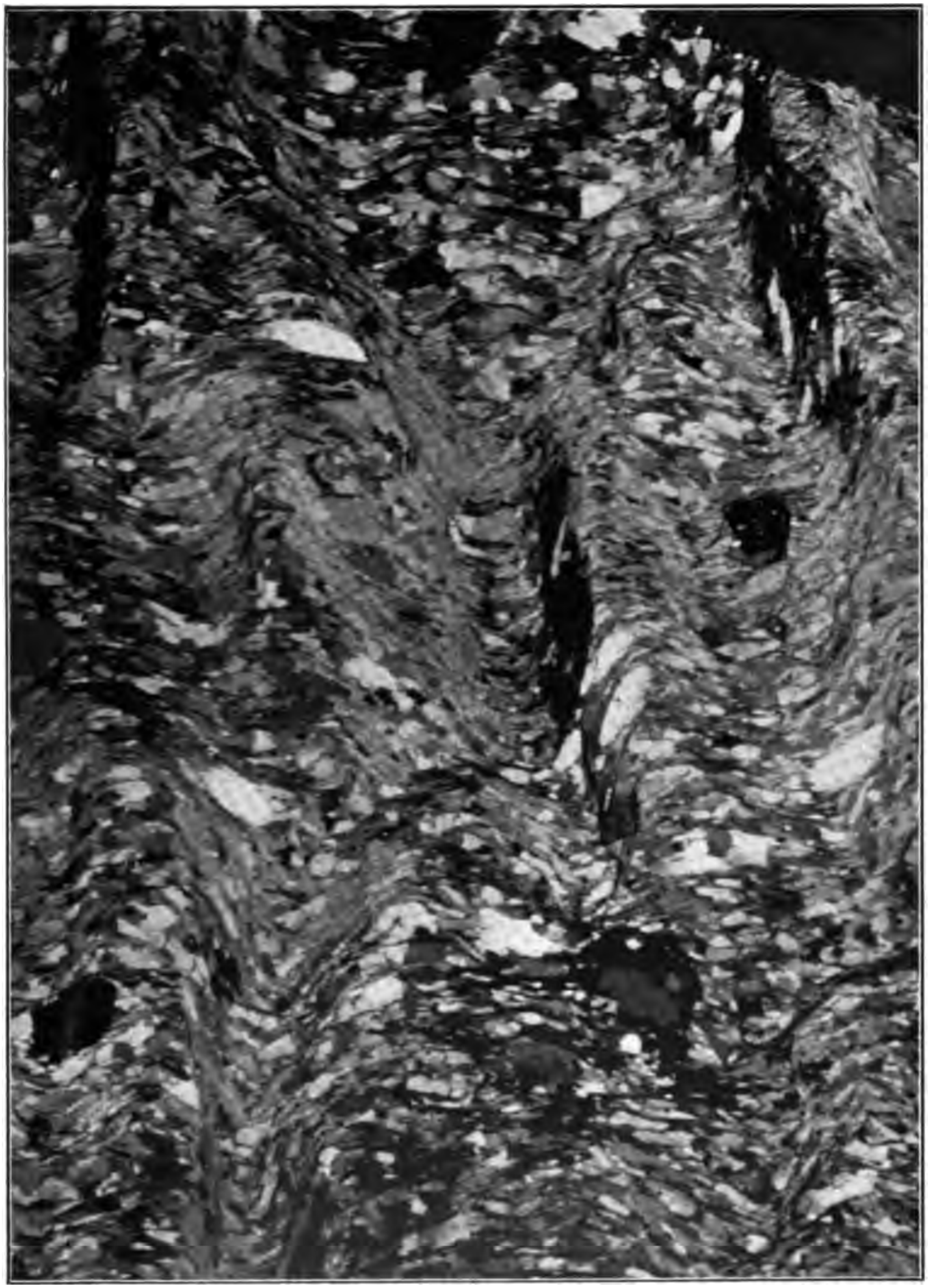
U.M.—Muscovite and quartz well foliated; some bands richer in quartz, others in muscovite. Occasional crystals of garnet, varying from colourless to brownish-red, sometimes colourless in the centre, red in the outer zone.

Mica Schist, containing garnets.



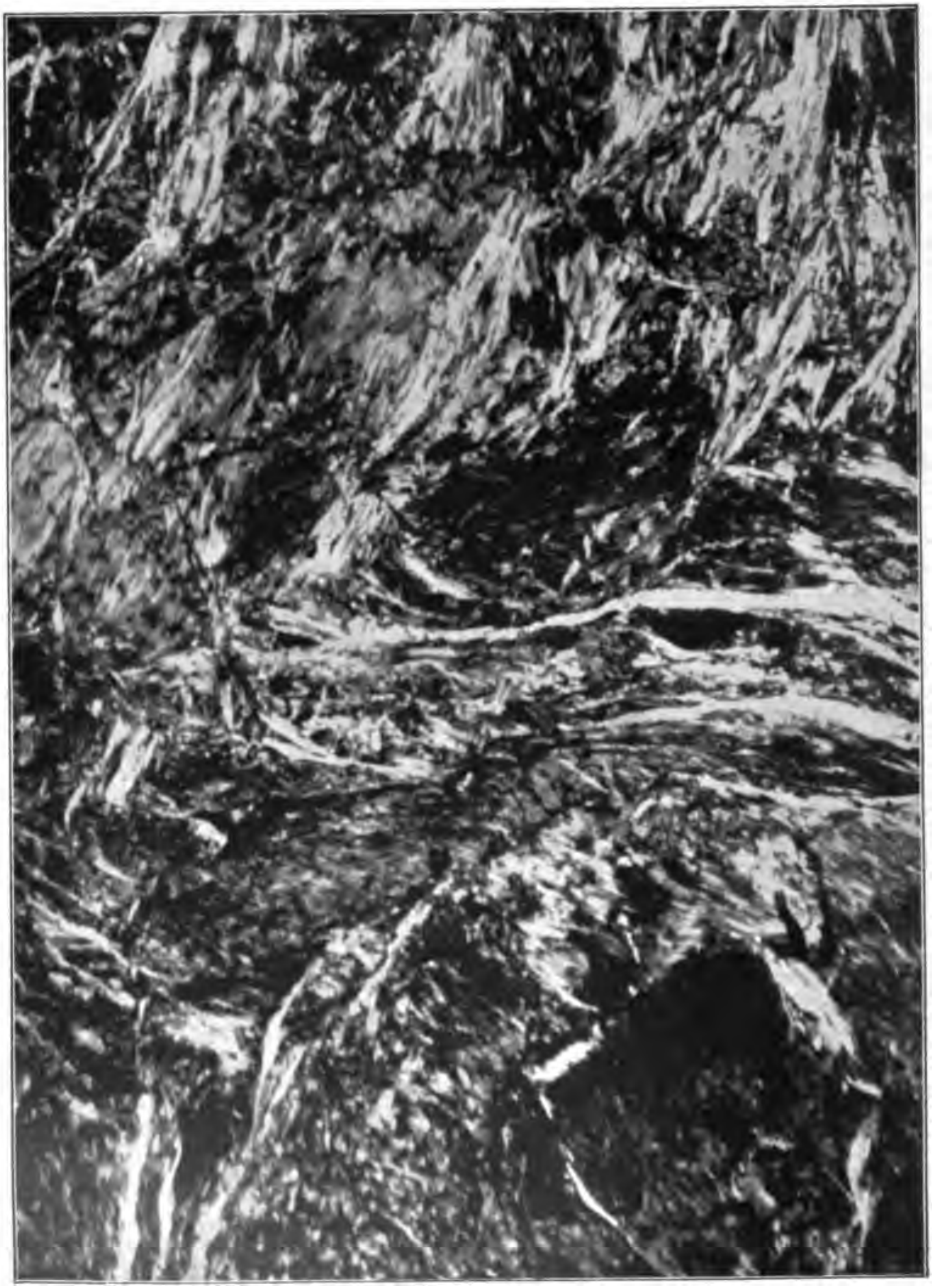
No. 463/1482. MUSCOVITE ROCK.

[*To face p. 186, Vol. II.*
i.



No. 464/1486. MICA SCHIST.

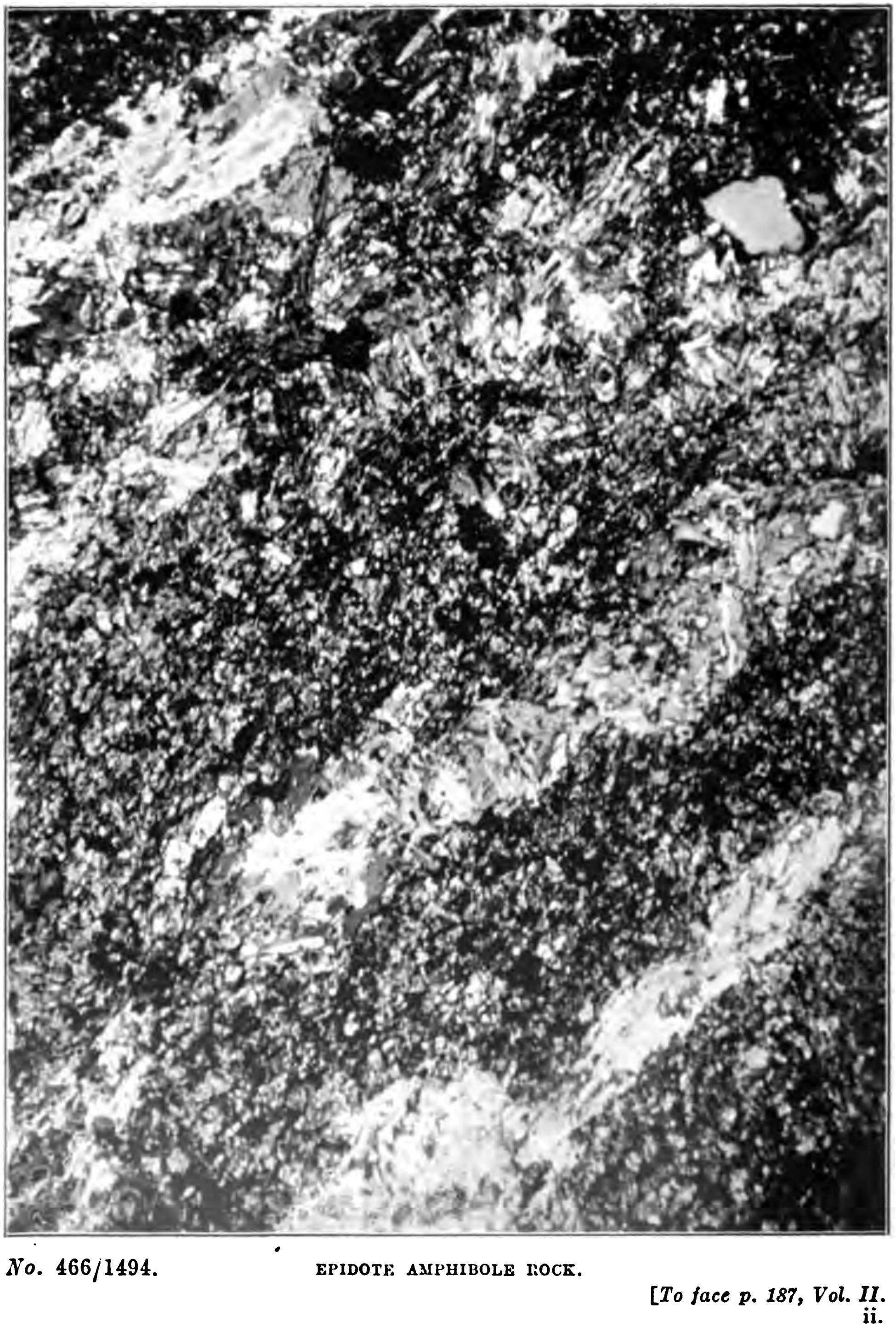
[*To face p. 186, Vol. II.*
ii.



No. 465/1493. SERPENTINE SCHIST.

[*To face p. 187, Vol. II.*

i.



No. 466/1494. EPIDOTE AMPHIBOLE ROCK.

[*To face p. 187, Vol. II.*
ii.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters; area photographed, nearly the whole of the slice, which is small.

Locality.—Second gorge of the Arahura River, Westland.

Formation.—Middle schists of Westland.

Remarks.—The whole of the mica schists from the gneissic granites of the Arahura-Wahininini to the sub-schists closing the metamorphic series are contained in the second gorge of the Arahura, the upper part of which is called the Crowbar Gorge.

No. 465/1493.

M.C.—Dark-green rudely foliated serpentine.

U.M.—Greenish almost colourless serpentine, with a little associated talc and muscovite. Pyrites is present in granules, especially where the serpentine best preserves a pseudomorphic form, which, for the most part, it has lost by crush and recrystallization.

Serpentine Schist.

Illustration.—Slice shows poor contrasts.

Photographed by polarised light; magnification, 33 diameters; the effect of polarised light on this specimen is somewhat remarkable.

Locality.—Arahura Valley, Westland.

Formation.—The olivine belt between the second and the upper divisions of the schists of Westland.

Remarks.—From the middle part of the second division of the schists and close to the copper-bearing rocks of the olivine belt—the higher part of the middle schists.

No. 466/1494.

M.C.—Heavy obscurely foliated compact crystalline rock.

U.M.—Granular aggregate of colourless, pale-yellow, or greenish-yellow epidote, and prisms of colourless amphibole, ext. 21°, which includes epidote.

Patches of larger and clearer crystals of epidote occur with obvious pleochroism, colourless / greenish-yellow. An occasional grain of quartz may be observed. There is also a little zoisite.

The epidote abounds in minute, colourless, generally rounded inclusions the mineral character of which is problematical.

Epidote Amphibole Rock.

Illustration.—Slice shows fair contrasts.

Photographed by ordinary light; magnification, 33 diameters.

Locality.—Arahura Valley, Westland.

Formation.—Middle schists of Westland.
Remarks.—The specimen is from the middle part of the second gorge of the Arahura River.

No. 467/1497.

M.C.—Brownish amphibole in finely fibrous radiate aggregates, with quartz and biotite.

U.M.—*Amphibole:* Faint-brownish or reddish-brown, twinned; ext., 17°; contains quartz.

Quartz: In clear mosaics, with single flakes of olive-green biotite irregularly scattered following the limits of the constituent quartz grains.

Biotite: Also in large flakes, brownish-yellow / black.

Garnets: Colourless, containing quartz and traversed by biotite.

Magnetite grains.

Amphibole Quartz Biotite Garnet Schist.

Locality.—Arahura Valley, Westland.
Formation.—Middle schists of Westland.
Remarks.—From the middle part of the second gorge of the Arahura River.

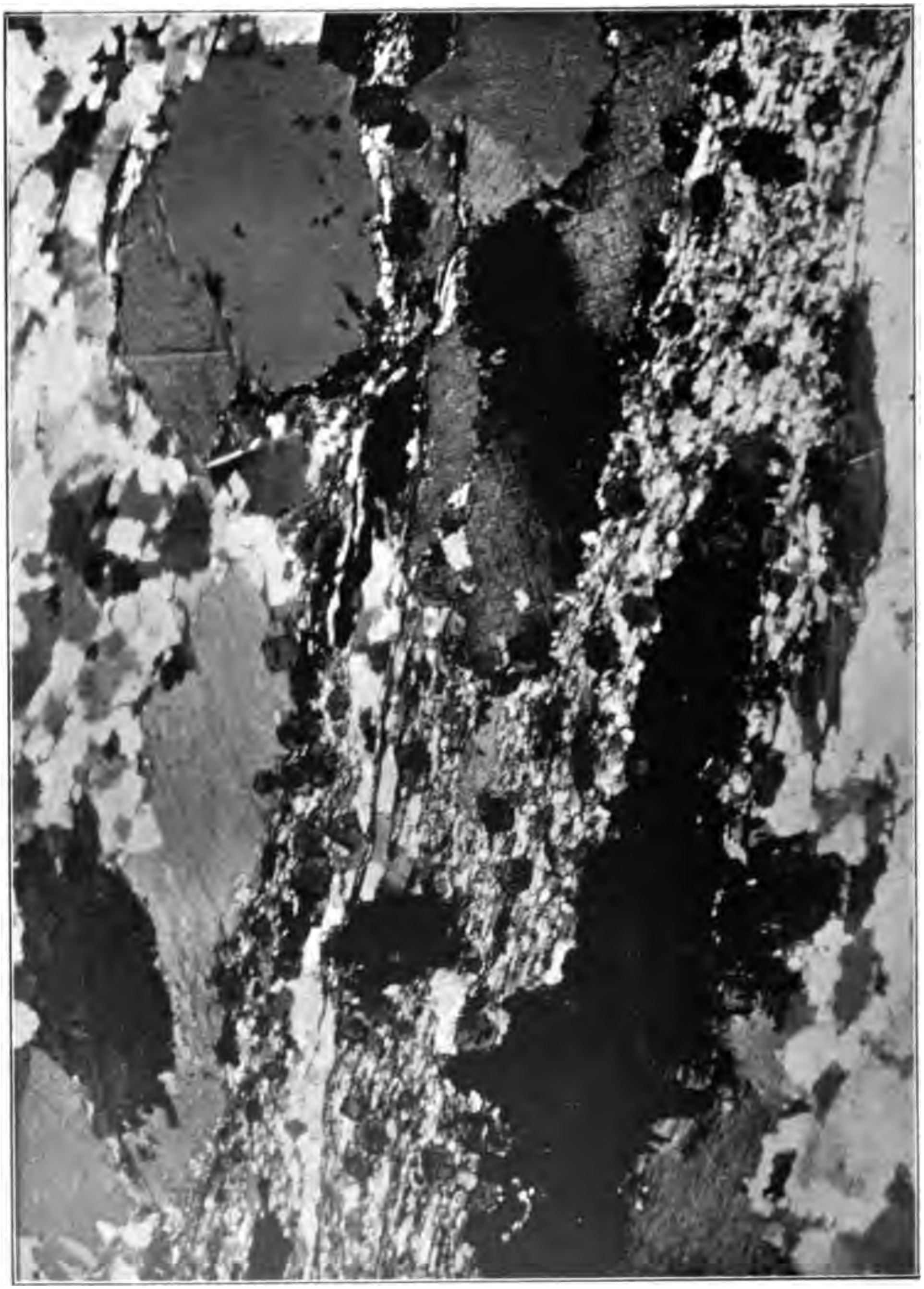
No. 468/1500.

M.C.—Flesh-coloured fine-grained schist, with gerbs of actinolite and flakes of biotite lying in the foliation planes.

U.M.—Phacoided large flesh-coloured and red garnets, streaks of minute colourless garnets, quartz mosaics, large prisms of radiate aggregates of actinolite, bluish-green / yellowish-green; ext., 19°; containing inclusions of quartz and garnet and a few large crystals of apatite. Very abundant magnetite, a little epidote and chlorite, but no biotite in the slices. Some of the large garnets are not only phacoided, but cracked transversely to the foliation (blatt lines), and the cracks are filled with quartz.

Garnet Actinolite Biotite Schist, with much magnetite.

Locality.—Arahura Valley, Westland.
Formation.—Middle schists.
Remarks.—From the middle part of the second gorge of the Arahura River.



No. 469/1502. QUARTZ GARNET BIOTITE SCHIST.

[*To face p. 189, Vol. II.*

No. 469/1502.

M.C.—Very evenly banded quartz mica schist.

U.M.—Well-banded schist; some bands consist chiefly of quartz mosaic having the grains flattened in the planes of foliation, traversed by streams of prismatic microliths of undeterminate character, with occasional flakes of biotite and crystals of garnet. Other bands consist chiefly of garnets, with subordinate quartz and biotite, and the garnets are dusty with microliths which run with the foliation. Other bands, again, consist chiefly of biotite in large crystals; pleochroism brownish or straw-yellow / yellowish-brown; isolated garnets occur in the biotite, and sometimes streams of microliths; a little muscovite is associated.

Magnetite occurs in the garnet and biotite bands.

Quartz Garnet Biotite Schist.

Illustration.—Slice shows fair contrasts.
Photographed by polarised light; magnification, 33 diameters.
Locality.—Second gorge of the Arahura River, Westland.
Formation.—Lower part of the middle schist.
Remarks.—Underlain by garnetiferous and followed by actinolite and talc-schists.

No. 470/1503.

M.C.—Schist, containing black needle-like prisms of amphibole.

U.M.—Arabesque and fine-grained quartz mosaics, with small crystal grains of colourless yellow epidote; scattered plates of biotite straw-yellow / olive-brown, and abundant elongated prisms of actinolite straw-yellow / yellowish-green / bluish-green. Grains of magnetite are generally dispersed.

Amphibole Epidote Quartz Schist.

Locality.—Gorge of the Hokitika River, Westland.
Formation.—Middle schists of Westland.
Remarks.—The specimen was collected from the shingle of the river-bed at the lower end of the gorge.

No. 471/1504.

M.C.—Pale greenish-grey calcareous schist.

U.M.—A foliated aggregate of carbonates and tremolite, the latter in colourless simple prisms. Magnetite grains are fairly common, and here and there an "eye" of serpentine may be seen. Numerous shear planes contribute to produce the schistosity. There are traces of talc.

Tremolite Calc-schist.

Illustration.—Slice shows fair contrasts.
Photographed by polarised light; magnification, 33 diameters.
Locality.—Gorge of the Hokitika River, Westland.
Formation.—Middle schists of Westland.
Remarks.—From the olivine and serpentine belt of the middle schists.

No. 472/1505.

M.C.—Green serpentine, with carbonates in thin veins.

U.M.—Amphibole in large crystals, faint-green / straw-yellow / faint bluish-green; ext., 20°; double refraction fairly strong.

Dolomite: In large plates, with included amphibole.

Magnetite: Some fairly large grains.

Talc and ***serpentine*** form the greater part of the rock, evidently as pseudomorphs after some ferro-magnesian or magnesian silicate; probably both these and the tremolite came from an olivine rock.

Talc Serpentine Rock, containing amphibole and dolomite.

Locality.—Hokitika Gorge, Westland.
Formation.—Olivine belt of the middle division of the schists of Westland.
Remarks.—Collected at the lower end of the gorge, and from the shingle of the river-bed.

No. 473/1526.

M.C.—Green serpentine schist.

U.M.—A felt of small fibres of serpentine, with granules and grains of magnetite aligned in the foliation planes. Some of the larger grains of magnetite form minute eyes.

Probably once an olivine rock, since serpentinised, and crushed into schist.

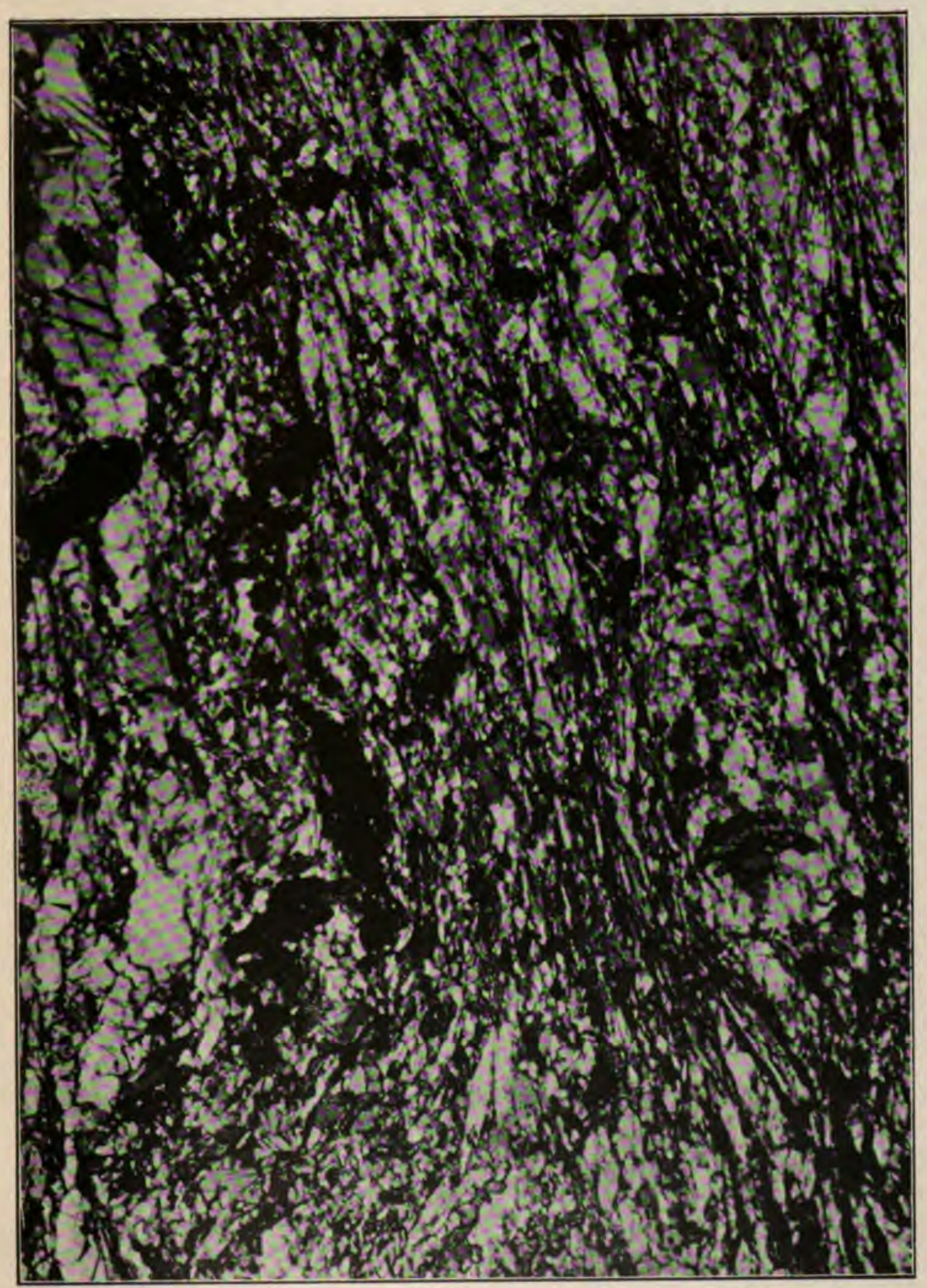
Green Serpentine Schist.

Locality.—Arahura Valley, Westland.
Formation.—Middle schists of Westland.
Remarks.—The specimen comes from the near vicinity of the olivine and serpentine belt.

No. 474/1527.

M.C.—Chlorite schist spotted with magnetite.

U.M.—A felt of chlorite scales, pleochroism faint straw-yellow / faint bluish-green; ext., 0°; optic sign, —; double refraction weak.



No. 471/1504. TREMOLITE CALC-SCHIST.

[*To face p. 190, Vol. II.*

Magnetite: In large well-formed crystals, as commonly happens in chlorite schist.

Chlorite Schist.

Locality.—Arahura Valley, Westland.
Formation.—Middle division of the schists of Westland.
Remarks.—From the second gorge of the Arahura River.

No. 475/1529.

M.C.—Garnet amphibole schist.

U.M.—Foliated aggregate of quartz mosaics; crushed flesh-coloured garnets, with a finely granular structure; abundant magnetite, sometimes in fairly large crystals. Amphibole straw-yellow / bluish-green / yellowish-green; ext., 21°. Biotite very sparingly present, yellowish / dark-greenish or reddish-brown.

Quartz Garnet Amphibole Schist.

Locality.—Arahura Valley, Westland.
Formation.—Middle division of the schists of Westland.
Remarks.—From the second gorge of the Arahura River.

No. 476/1532.

M.C.—Schist, with radiate greenish-black amphibole; flecks of biotite and white finely granular quartz.

U.M.—Quartz very fine-grained aggregates, probably a crush mosaic with streams of minute flakes of muscovite and small crystals of epidote and zoisite running with the foliation. Foliæ of coarse biotite, faint straw-yellow / deep yellowish-brown, with marks of pressure, and associated magnetite also drawn out. Aggregates of quartz mosaic, chlorite, and epidote are also present. The biotite is truly uniaxial.

This slice does not show amphibole, but it is obvious in the hand-specimen as black prisms shooting through the rock, and deformed by pressure. A separate examination under the microscope shows that this is a true amphibole, yellowish-green / bluish-green; ext., 21°.

Apatite, as well as other minerals, is present in the biotite.

Quartz Amphibole Biotite Epidote Schist.

Locality.—Arahura Valley, Westland.
Formation.—Middle schists.
Remarks.—From the middle part of the second gorge of the Arahura River.

No. 477/1537.

M.C.—Quartz mica schist, with garnet " augen."

U.M.—Bands of (i) quartz mosaic with calcite, isolated green biotite, and fragmentary garnet networks; (ii) biotite, straw-yellow / green and occasionally brown, with associated magnetite, which is sometimes " phacoided." Large " augen " of flesh-coloured garnet, with included magnetite and quartz, are to be seen.

Quartz Biotite Garnet Schist.

Locality.—Second gorge of the Arahura River, Westland.
Formation.—Lower schists.
Remarks.—These schists form the lower (western) part of the second gorge of the Arahura.

No. 478/1539.

M.C.—Dark (black) schist, with obvious copper-pyrites.

U.M.—Large hypidiomorphic crystals of colourless amphibole, pervaded, surrounded, and intergrown with magnetite, which forms large granular aggregates in the midst of which pyrites occur in much smaller quantity. Serpentine forms part of the slice in place of tremolite. The magnetite is so abundant that fairly large fragments will hang on to a magnet.

Tremolite Serpentine Magnetite Schist.

Locality.—Arahura Valley, Westland.
Formation.—Serpentine of the middle schists of Westland.
Remarks.—From the middle part of the second gorge of the Arahura River.

No. 479/1548.

M.C.—Schists, with obvious well-crystallized cinnamon-coloured garnets.

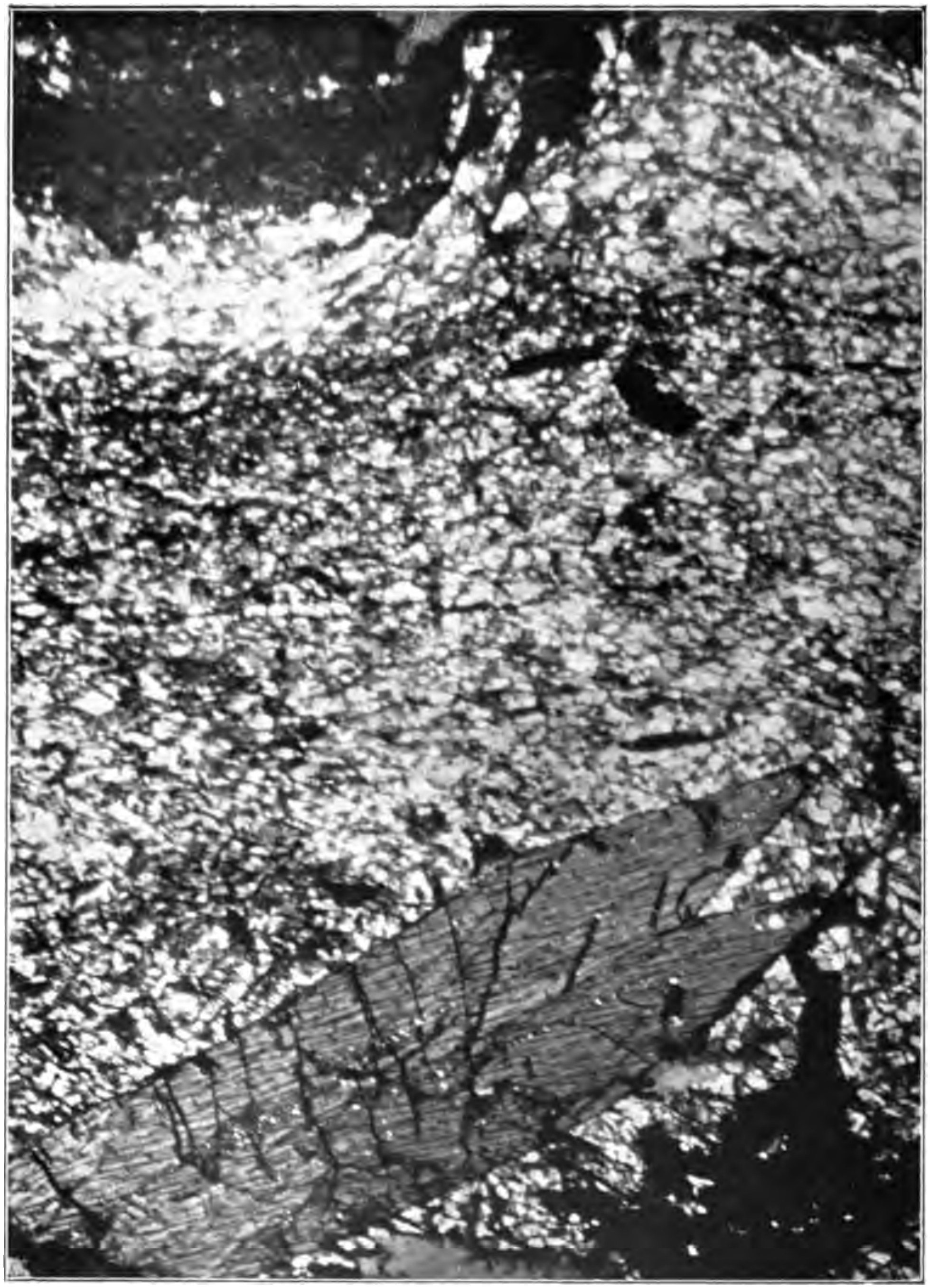
U.M.—*Quartz:* As a mosaic, or a collection of angular quartz grains, each defined by biotite films, giving the appearance of " crackling " on porcelain.

Actinolite: In large prisms running with the foliation, pleochroism greenish-blue / yellowish-green / straw-yellow; traversed by inclusions of quartz, which form a long train running with the foliation.

Pyrites is present in cracks and forming foliation streaks.

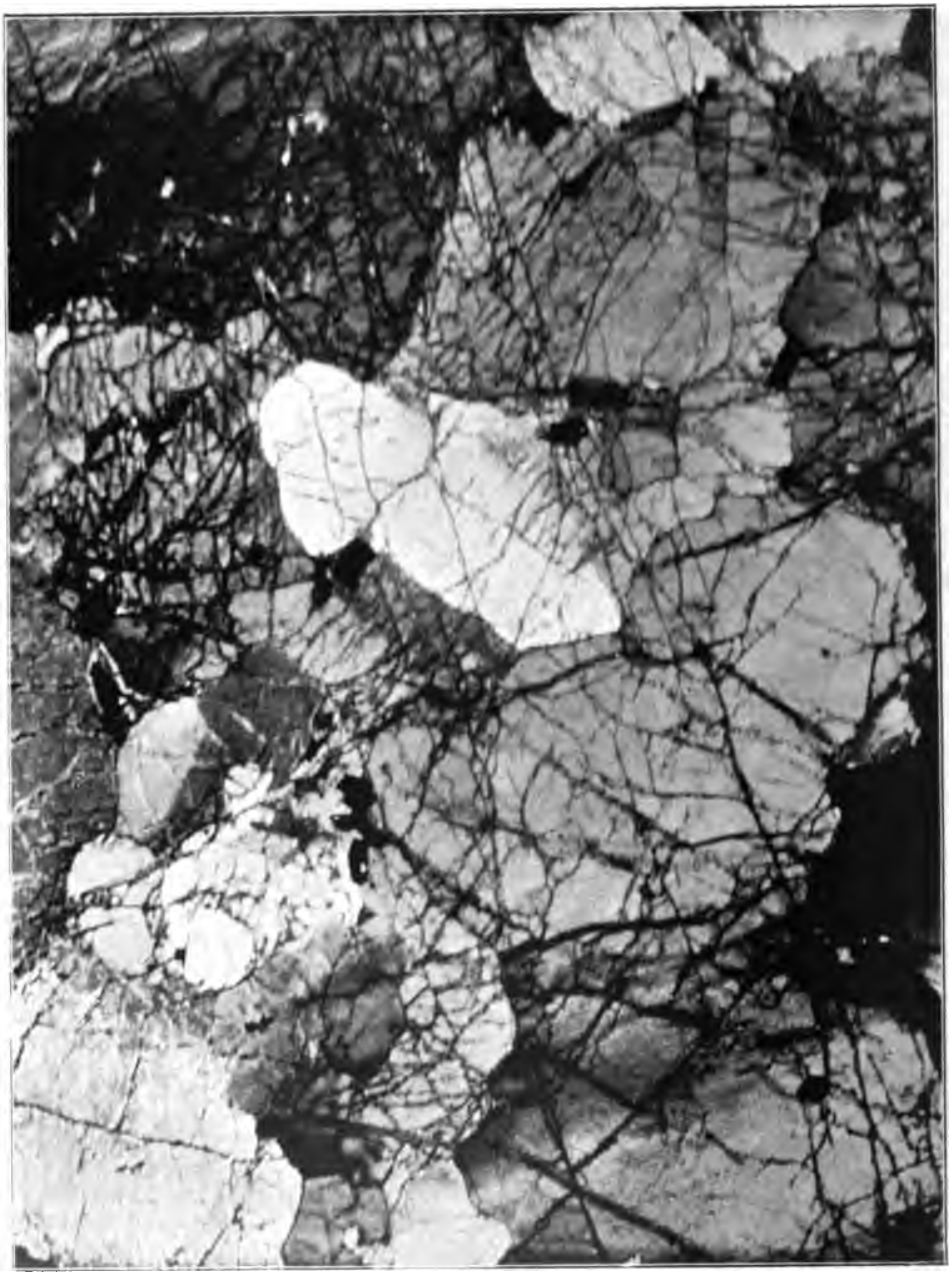
Garnets: Large, crushed, present a remarkable structure; quartz is so abundantly included as to reduce the garnet substance to a network, but a part of this network has the form of straight elongated rods or radiate prism-like growths.

Green Amphibole Quartz Schist.



No. 479/1548. GREEN AMPHIBOLE QUARTZ SCHIST.

[*To face p.* 192, *Vol. II.*



No. 481/1553. DUNITE.

[To face p. 193, Vol. II.

Illustration.—Slice shows fair contrasts.
Photographed by polarised light; magnification, 33 diameters.
Locality.—Arahura Valley, Westland.
Formation.—Lower division of the schists of Westland.
Remarks.—The specimen is from the higher part of the lower schists.

No. 480/1551.

M.C.—Brecciated coarsely crystalline granite.

U.M.—*Plagioclase: R.i.*, above balsam; ext., 0°. Other examples in which *r.i.* not determined; ext., 15° (oligoclase–andesine probably). Twinning bands usually close and fine, bent by pressure; crystals fractured and faulted. Scales of chlorite developed along twinning planes and in cracks.

Orthoclase is less abundant, in some cases thread-like micropegmatite developed about the margins.

Quartz: Large-grained mosaics, partly crushed and converted into arabesque mosaic along the crush-lines.

Biotite: Brown / straw-yellow cleavage, often bent and contorted. The lines of phacoiding in the granite are frequently determined by the biotite.

Sphene: In large crystals.

Epidote: A good deal of colourless epidote, especially along crush-lines.

Granitite.

Locality.—Mount Turiwhate, Teremakau Valley, Westland.
Formation.—Gneiss granite formation of Westland.
Remarks.—The great bulk of this formation is granitoid gneiss. The western base of Turiwhate, whence the specimen comes, shows rock without indications of gneissic structure.

No. 481/1553.

M.C.—Massive olivine rock.

U.M.—A coarse mosaic of fresh olivine. Some of the grains synthetically twinned; ext., 8° / 8°; with twinning planes. Sheets of vapour cavities, mostly quite irregular in form, are common.

Picotite: In fairly large almost opaque crystal grains, brownish-red in sufficiently thin slices, is scattered generally through the rock, also *chrcmite.*

Augite: In pale-greenish crystals rounded at the angles, very rare.

Lines of minute brecciation cross the slice.

Dunite.

Illustration.—Slice shows moderate contrasts.
Photographed by polarised light; magnification, 33 diameters.
Locality.—Gorge of the Hokitika.
Formation.—Middle schists of Westland.
Remarks.—The olivine and serpentine belt occurs in the upper part of this division of the schists of Westland.

No. 482/1564.

M.C.—Schist, with actinolite in foliation planes and crushed garnets.

U.M.—Bands (i.) of quartz-mosaic, the grains flattened in the foliation planes, traversed by strings of minute colourless garnets running with the foliation, and shot through with actinolite. Films of brown biotite lie between the grains in some places. The actinolite contains quartz which is sometimes restricted to its axial or central parts, its pleochroism is faint yellowish-green / bluish-green. (ii.) Of minute colourless garnets (flesh-coloured in the mass) forming more or less lenticular areas, with associated quartz, a good deal of magnetite, and some actinolite.

Garnet Actinolite Schist.

Illustration.—Slice shows moderate contrasts.
Photographed by polarised light; magnification, 33 diameters.
Locality.—Arahura Valley, Westland.
Formation.—Middle schists.
Remarks.—From the middle part of the second gorge of the Arahura River.

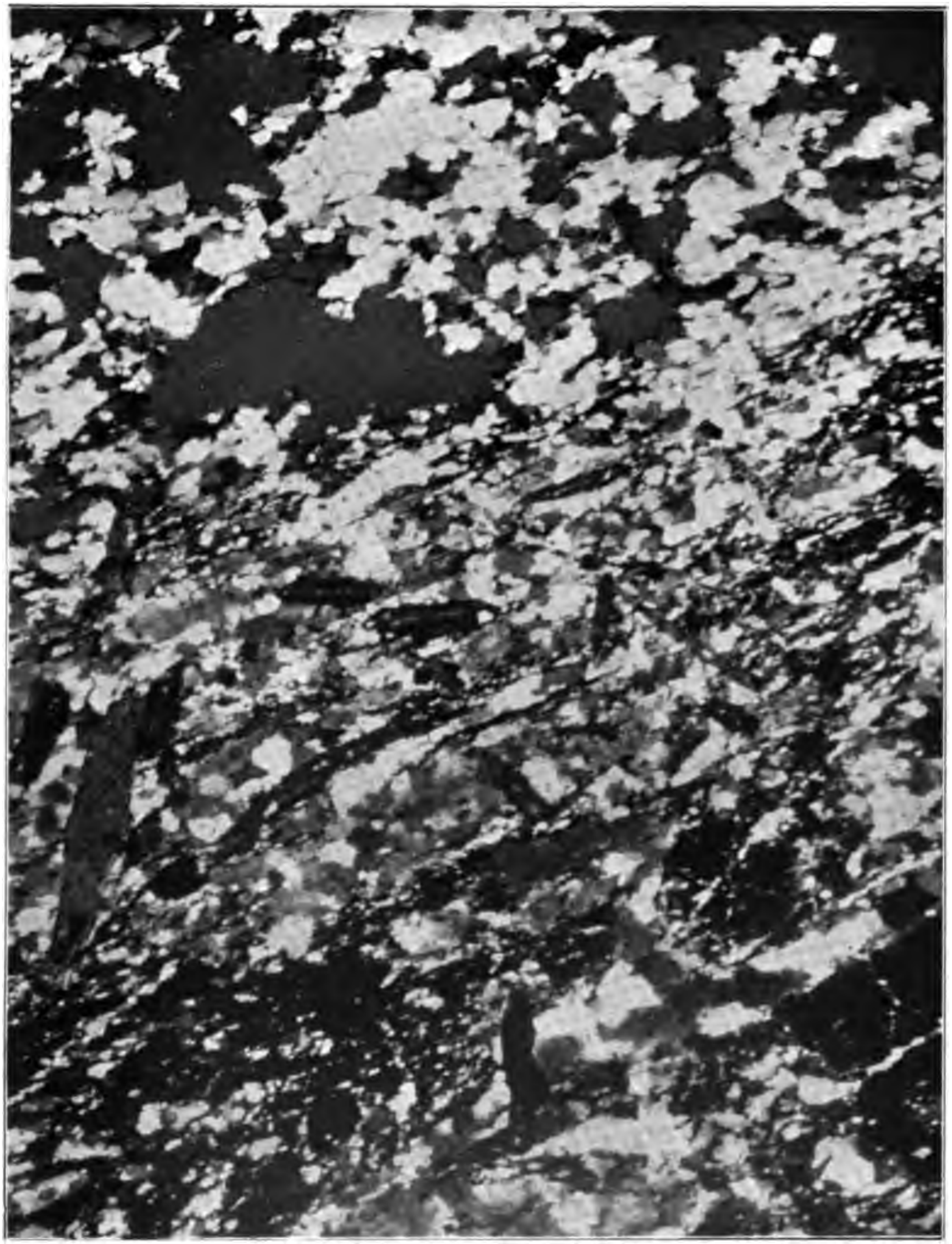
No. 483/1572.

M.C.—Closely foliated pale-green schist.

U.M.—A felt of colourless elongated prisms, orientated in all directions in the planes of foliation; ext., 20°; sign +. Some appear to be far more strongly anisotropic than others, and also form a finer felt; the presence of more than one mineral is thus suggested, but I fancy this is not the case. The difference in double refraction is due to difference in orientation. The mineral is evidently a colourless amphibole, probably tremolite. Serpentine forms the greater part of some bands.

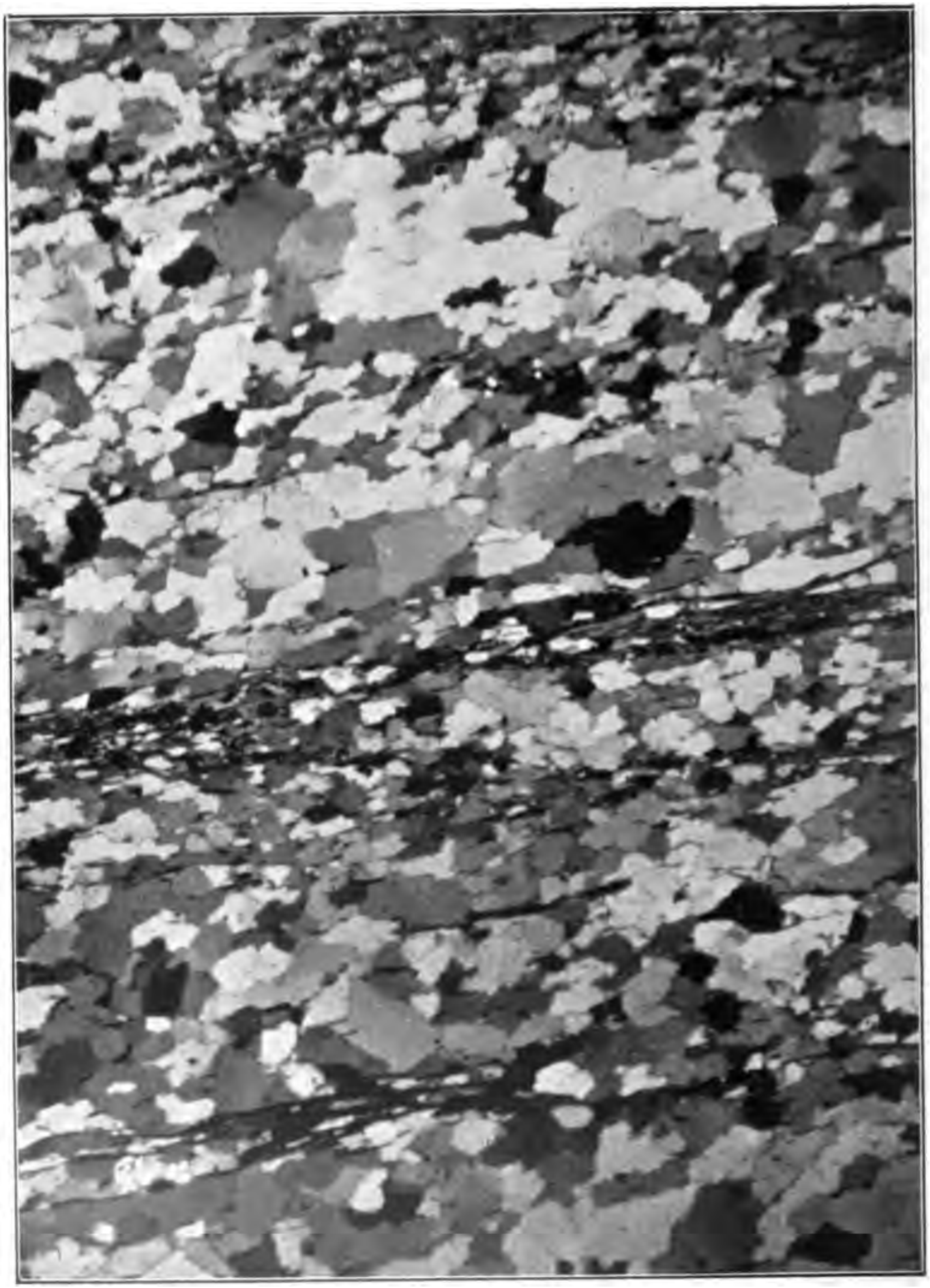
Amphibole Serpentine Schist.

Locality.—Arahura Valley, Westland.
Formation.—Middle schists of Westland.
Remarks.—From the upper part of the middle schists and close to the olivine belt.



No. 482/1564. GARNET ACTINOLITE SCHIST.

[To face p. 194, Vol. II.



No. 484/1576. GARNET MICA SCHIST.

[To face p. 195, Vol. II.

No. 484/1576.

M.C.—Very quartzose schist, foliation planes glistening with mica.

U.M.—Quartz mosaics with the grains flattened in the foliation planes, and scales of greenish mica, straw-yellow / faint ferrous green, running with the foliation. Similar mica forms the thicker foliæ with associated colourless garnets, which are of various size but always small. Some brown biotite is also present.

Garnet Mica Schist.

Illustration.—Slice shows but medium contrasts.

Photographed by polarised light with the nicols so placed as to give the required contrast on the screen; magnification, 33 diameters.

Locality.—Arahura Valley, Westland.

Formation.—Lower part of the middle division of the schists of Westland.

Remarks.—From the middle part of the Second Gorge of the Arahura River.

No. 485/1583.

M.C.—Talcose-looking schist.

U.M.—The mass of the rock is formed of a fine felt of serpentine, with grains, often very minute, of pyrites and magnetite. In places the serpentine fibres become coarse and blatt-like, and are then frequently associated with pyrites and a colourless mineral of high refraction and strong double refraction, which is evidently a colourless amphibole.

Serpentine Schist, containing tremolite.

Locality.—Gorge of the Hokitika River, Westland.

Formation.—Upper part of the middle division of the schists of Westland.

Remarks.—The specimen was collected from the river-bed at the lower end of the gorge. The serpentine belt crosses the river some distance above the deeper part of the gorge.

No. 486/1584.

M.C.—Finely foliated dark mica schist.

U.M.—Foliated aggregate of very fine-grained quartz mosaics, biotite, and calcite.

The quartz mosaics are more or less densely charged with needles of actinolite or tremolite, and prisms and granules of colourless epidote running with the foliation.

The biotite is in large fresh crystals, straw-yellow / olive-brown, the calcite in rather large grains, containing as the biotite does also similar inclusions to those in the quartz but to a less extent.

Biotite Mica Schist, containing amphibole and calcite.

Illustration.—Slice shows medium contrasts.
Photographed by polarised light; magnification, 33 diameters.
Locality.—Arahura Valley, Westland
Formation.—Middle division of the schists of Westland.
Remarks.—The specimen is from the lower part of the middle schist.

No. 487/1586.

M.C.—Black slate or phyllite.

U.M.—Composed of sericite and quartz grains, the sericite flakes lying with their flat faces in the planes of foliation, the quartz often in minute lenticles; a few scales of chlorite are also present, and granules of a colourless mineral, with high *r.i.* and strong double refraction. This is somewhat abundant, evidently silicate of some kind, but too minute to determine with certainty.

Phyllite.

Illustration.—Slice shows but poor contrasts, the grains of the rock being very fine.

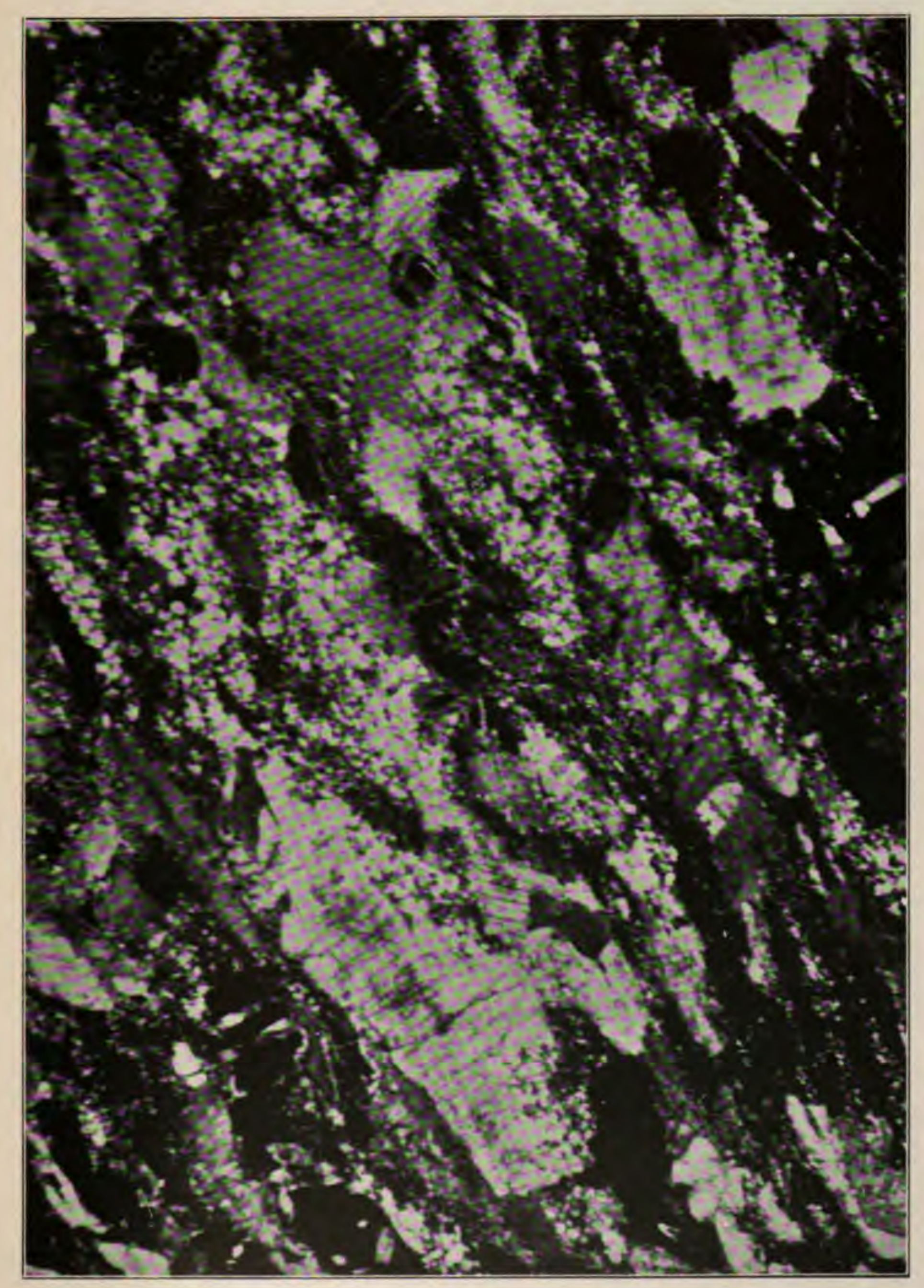
Photographed by polarised light, which afforded the needed contrast; magnification, 33 diameters.
Locality.—Jackson's to Rocky Point, Teremakau Valley, Westland.
Formation.—Devonian.
Remarks.—The lower part of the formation is, if this be not, submetamorphic; and the whole is in apparent conformable succession to the highly metamorphic schists that underlie. East of Jackson's Carboniferous strata follow the Devonian with apparent conformity.

No. 488/1587.

M.C.—Black mica schist, which has apparently undergone more than one crush.

U.M.—Fairly coarse quartz mosaic, grains flattened in foliation planes. Biotite irregularly scattered; some following the foliation, some running across it following the limits of the quartz grains.

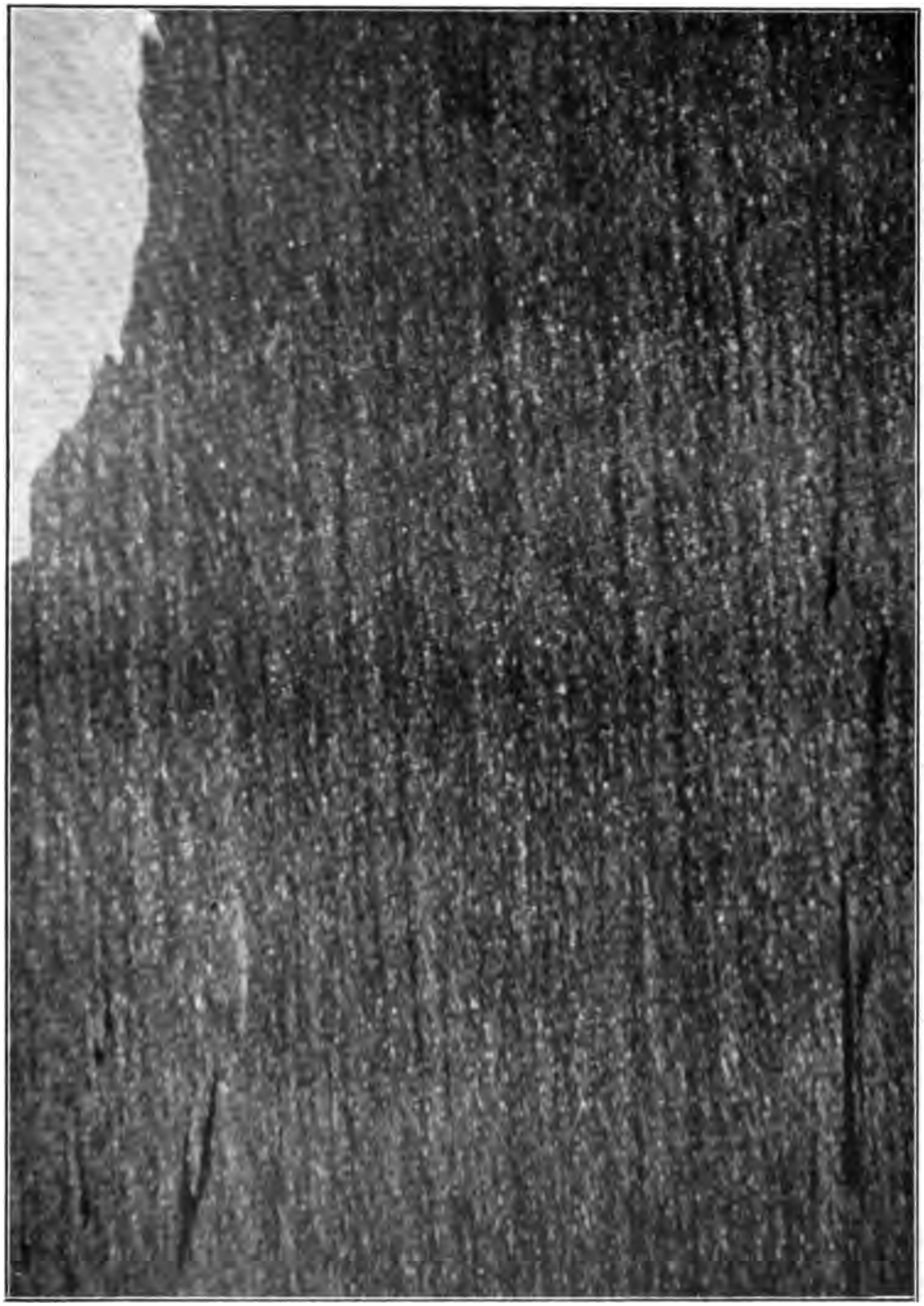
Quartz Biotite Schist.



No. 486/1584. BIOTITE MICA SCHIST.

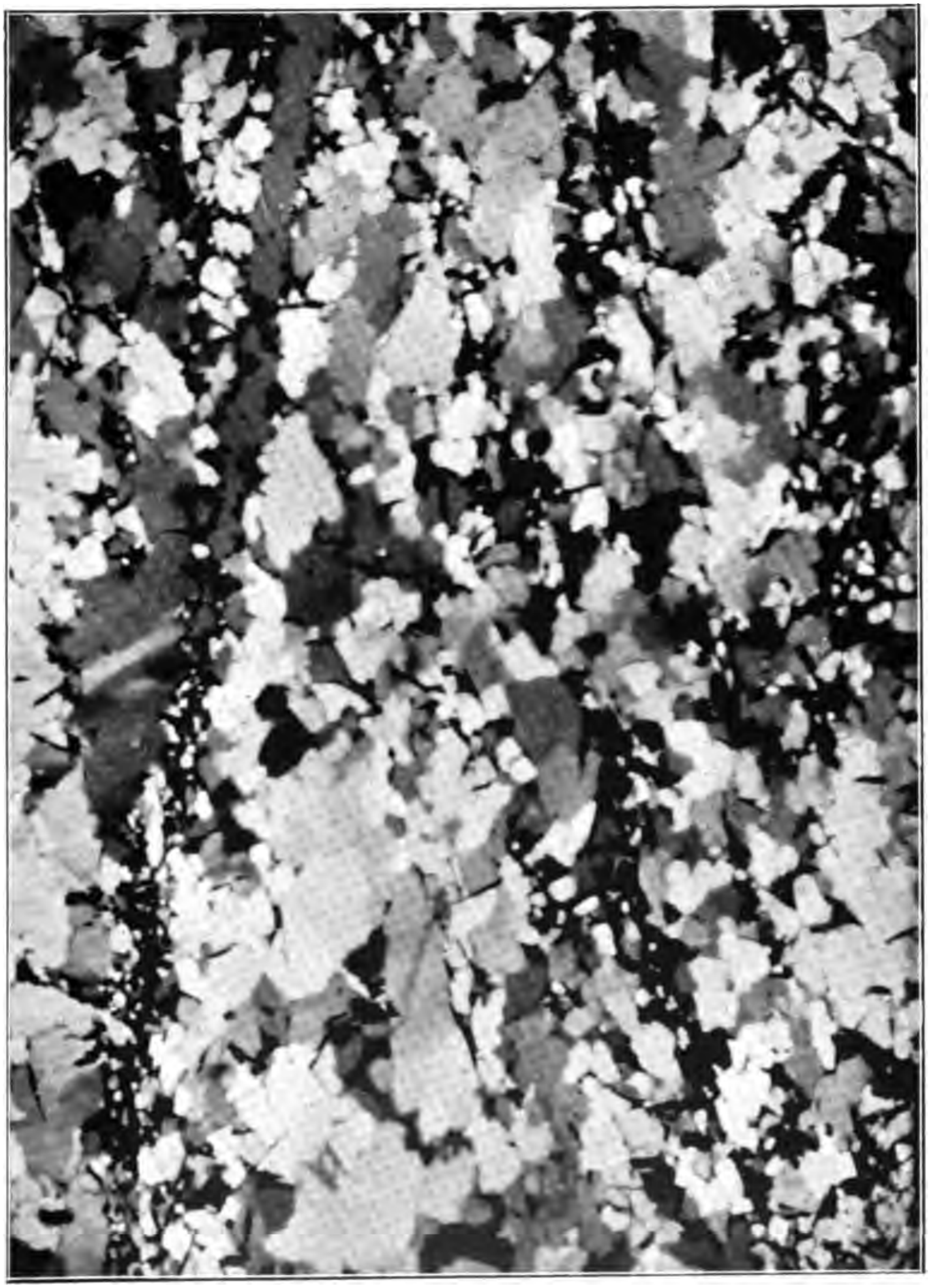
[*To face p.* 196, *Vol. II.*

i.



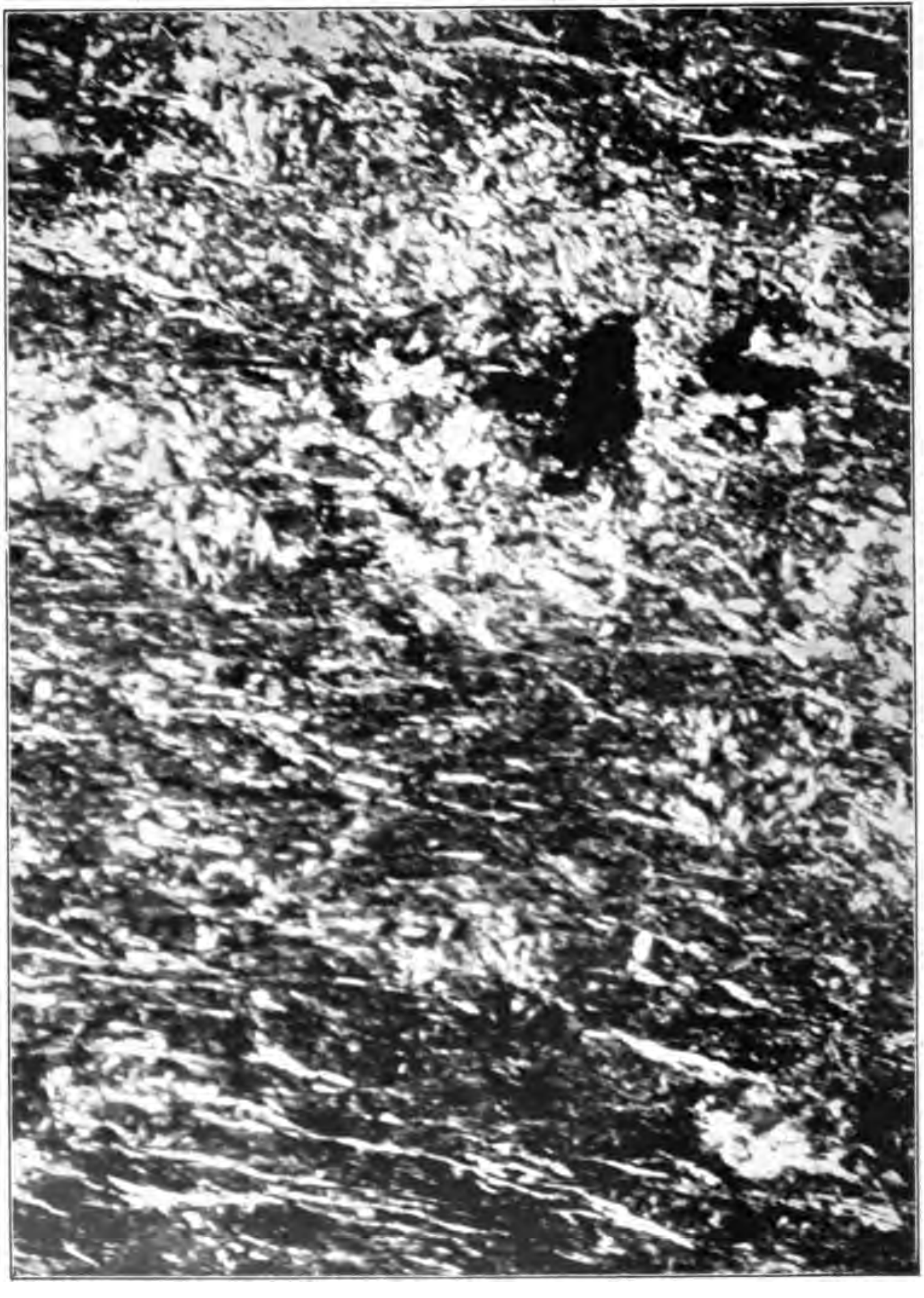
No. 487/1586. PHYLLITE.

[*To face p. 196, Vol. II.*
ii.



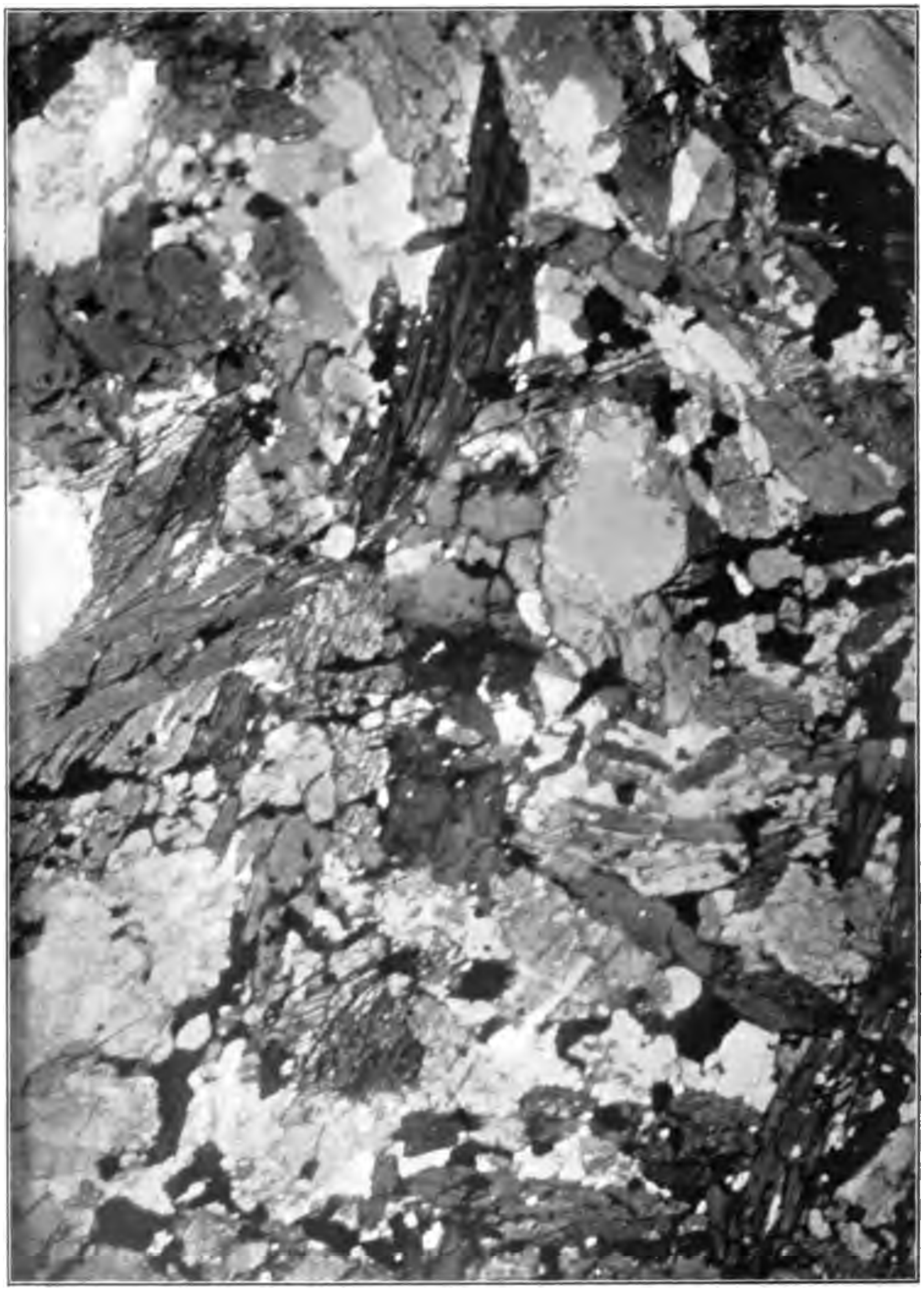
No. 488/1587. QUARTZ BIOTITE SCHIST.

[*To face p. 196, Vol. II.*
iii.



No. 489/1594. DOLOMITE SERPENTINE SCHIST.

[*To face p. 197, Vol. II.*
i.



No. 490/1595. AMPHIBOLE ROCK.

[*To face p. 197, Vol. II.*

ii.

Illustration.—Slice shows but medium contrasts.

Photographed by polarised light; nicols not fully but crossed to the degree that gave sufficient contrasts on the screen; magnification, 33 diameters.

Locality.—Arahura Valley, Westland.

Formation.—Upper schists of Westland (lower part).

Remarks.—From the upper part of the second gorge of the Arahura River.

No. 489/1594.

M.C.—Dolomite serpentine schist.

U.M.—A faint-green serpentinous mineral (colourless in thin slices) frequently in radiate prismatic growths, in others pseudomorphous after some other mineral; ext., 0°; optical sign, +; double refraction low. The precise nature of this mineral cannot be determined without a chemical analysis, but it is some variety of serpentine.

Dolomite is present, and magnetite in abundant dust and more continuous areas.

Dolomite Serpentine Schist.

Illustration.—Slice shows fair contrasts.

Photographed by polarised light; nicols not fully crossed; magnification, 33 diameters.

Locality.—Arahura Valley, Westland.

Formation.—Upper part of the middle schists of Westland.

Remarks.—From the middle part of the second gorge of the Arahura River.

No. 490/1595.

M.C.—Black amphibole rock.

U.M.—*Amphibole:* In large growths interfering in growth, straw-yellow / grass-green / bluish-green; ext., 24°; includes small prisms of epidote and zoisite.

Quartz mosaics interstitial, not abundant.

Pyrites: Some large interstitial growths; also grains and irregular growths included in amphibole.

Amphibole is also present.

Amphibole Rock.

Illustration.—Slice shows good contrasts.

Photographed by polarised light; magnification, 33 diameters. In this and most other cases the nicols were not crossed at right angles, but only to such a degree as gave the necessary contrasts for the production of desired strength in the negative.

Locality.—Arahura Valley, Westland.
Formation.—Middle division of the schists of Westland.
Remarks.—From the second gorge of the Arahura River, or the first in which schistoze rocks are found.

No. 491/1596.

M.C.—A very quartzose schist showing "rod" structure.

U.M.—(i.) Quartz mosaics containing andalusite, which is without crystal outlines; green biotite and small colourless garnets running in undulating foliation planes; a little magnetite is present. (ii.) A band of minute colourless garnets with a little quartz, and some magnetite, and also brownish-green biotite. (3.) A band of large crystals of green biotite, straw-yellow / brownish-green.

Garnet-bearing Biotite Mica Schist.

Locality.—Arahura Valley, Westland.
Formation.—Lower part of the middle schists of Westland.
Remarks.—This rock borders on the lower contorted schists which are more particularly the garnet-bearing rocks.

No. 492/1600.

M.C.—Quartz amphibole schist, with the amphibole, which is silvery and light-brownish, forming radiate growths in the foliation planes.

U.M.—Quartz mosaic, with the grains flattened in the plane of foliation and with lines of liquid or vapour cavities at right angles to the foliation planes (blatt lines). Greenish biotite scales are scattered through the mosaics (sometimes only a single lamella thick), and a little amphibole.

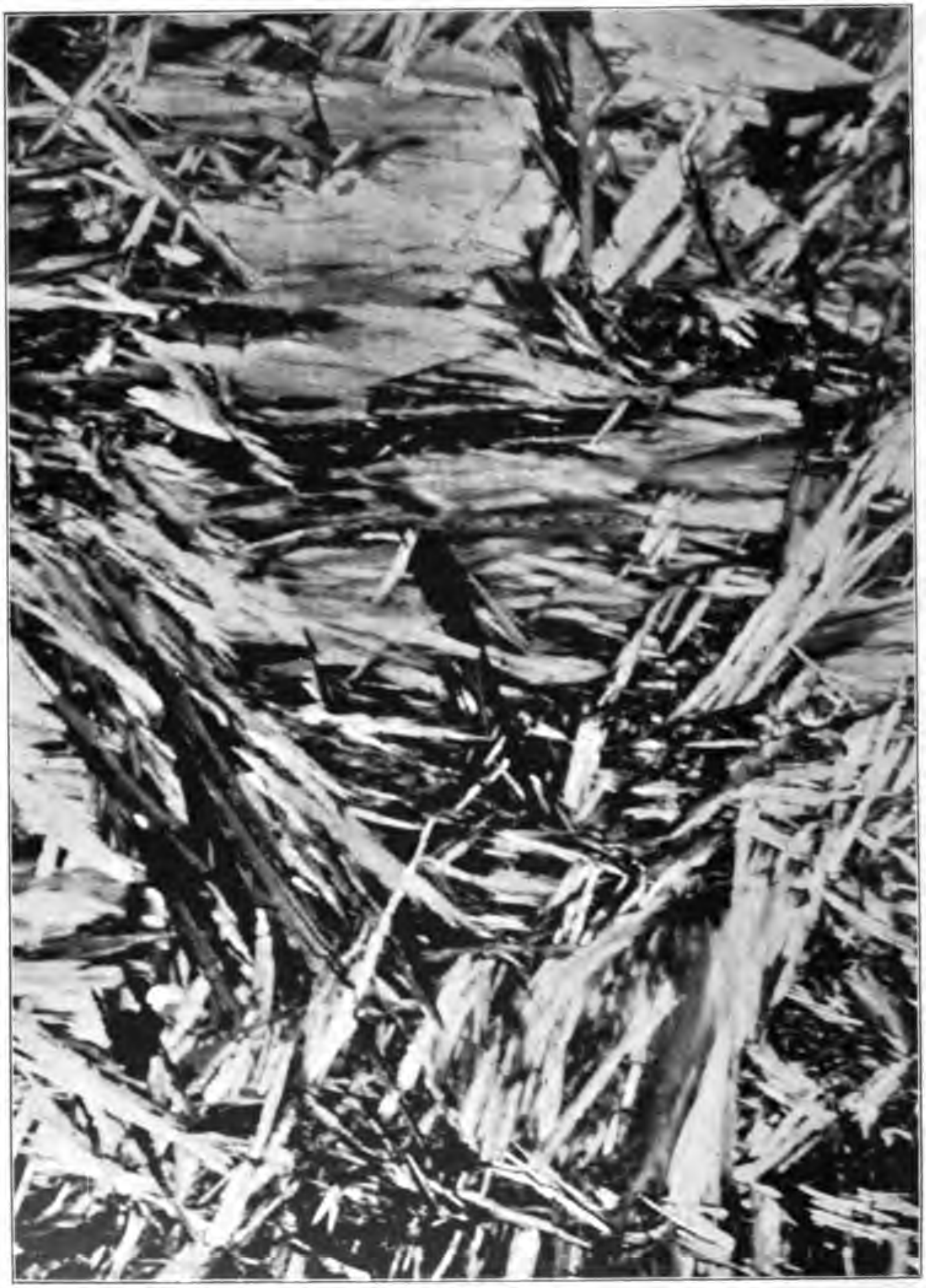
Amphibole is abundant as yellowish-brown prisms lying in all directions, but with a tendency to extend along the foliation planes; extinguished at 15°; pleochroism faint, altered to tremolite.

Garnets containing quartz and magnetite traversed by prisms of amphibole; sometimes the garnet forms only a network in the quartz without a crystal outline.

Magnetite is abundant, densely accumulated in places.

Amphibole Garnet Magnetite Schist.

Locality.—Second gorge of the Arahura River, Westland.
Formation.—Middle schists. Archaean.
Remarks.—The age of this rock is not easily determined, but the sequence upwards, so far as can be seen, reads—granite and gneiss; lower garnetiferous schists;



No. 493/1601. ALTERED OLIVINE ROCK.

[To face p. 199, Vol. II.

middle schists; serpentine or olivine belt; upper schist passing into unaltered Devonian rocks, and rocks of the Maitai series (Carboniferous) that form the higher part of the main axis to the eastward.

No. 493/1601.

M.C.—Green schist, composed largely of small prisms.

U.M.—Serpentine in radiating prisms of a faint-green colour; slightly pleochroic, green / colourless; double refraction low; ext., 0°; sign, +; specific gravity, 2·64. Patches of interstitial carbonate, rare strings of magnetite running with the foliation; traces of talc and remains of tremolite also.

An **Altered Olivine Rock**—Serpentine, with a little tremolite remaining.

Illustration.—Slice shows moderate contrasts.
Photographed by polarised light; magnification, 33 diameters.
Locality.—Teremakau Valley, Westland.
Formation.—Middle division of the schists of Westland.
Remarks.—This rock is abundant in the range between Rocky Point in the Teremakau Valley and the lower gorge of the Taipo River. The rock occurs massive, and could be quarried in blocks of almost any size. Its comparative softness makes it easily worked as a building-stone. It is of two varieties, a leek-green and a buff-coloured rock, and is associated with a rock consisting almost of pure muscovite.

No. 494/1611.

M.C.—Schist, with serpentine in radio-fibrous growths.

U.M.—Crushed and foliated *serpentine* and ferriferous *dolomite* crossed by blatt veins of dolomite. Colourless *amphibole* is abundant; ext., 25°; penetrated by thread-like intergrowths of dolomite it is partly transformed into talc. *Magnetite*, in dust and large grains, common. *Picotite* is also present; a very interesting fact, clearly pointing to the derivation of the schist from an olivine rock.

Dolomite Serpentine Tremolite Schist.

Locality.—Gorge of the Hokitika River, Westland.
Formation.—Middle division of the schists of Westland.
Remarks.—From the olivine belt forming the higher part of this division of the schists.

No. 495/1623.

M.C.—Dolomite talc-schist.

U.M.—A foliated aggregate of talc and dolomite, containing ferrous carbonate. Scattered grains of chromite are present. The talc has a specific gravity of about 2·8, the ferruginous dolomite of about 3·1. There is a considerable quantity of iron in the dolomite, and this accounts for its high specific gravity. The dolomite is quite as difficultly soluble in acids as nonferriferous varieties. The talc may easily be mistaken for muscovite under the microscope.

Dolomite Talc-schist.

Illustration.—Slice shows fair contrasts.

Photographed by polarised light; magnification, 33 diameters.

Locality.—Gorge of the Hokitika River, Westland.

Formation.—Olivine belt of the middle schists.

Remarks.—The serpentine and olivine rocks are often calcareous, but it is seldom that hand-specimens as pure as this can be obtained.

No. 496/1631.

M.C.—Schist, with copper-pyrites.

U.M.—Colourless amphibole; ext., 19°; forming a coarse entanglement of prisms. Two kinds of pyrites are included; one very dark-coloured in irregular areas (a good deal of this is magnetite), having another brighter, brassy-looking (copper-pyrites) within. Pyrites is also scattered in small crystals and granules.

Fragments of this rock will hang on to a magnet.

Amphibole Schist, with magnetite and pyrites.

Illustration.—Slice shows moderate contrasts.

Photographed by polarised light; magnification, 33 diameters.

Locality.—Arahura Valley, Westland.

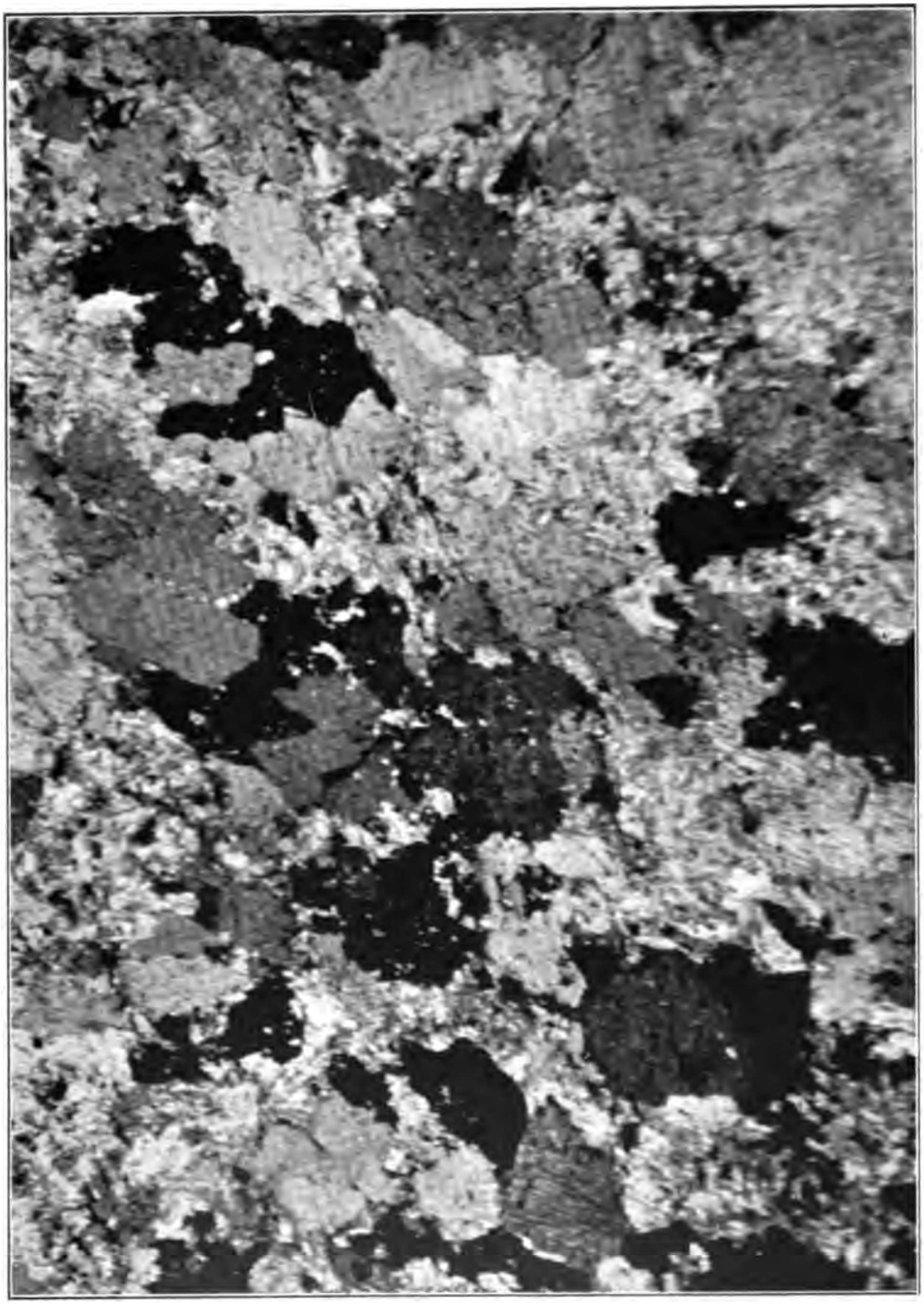
Formation.—Middle schists of Westland.

Remarks.—From the middle part of the second gorge of the Arahura River.

No. 497/1638.

M.C.—Finely foliated green schist.

U.M.—A foliated aggregate of quartz, amphibole, and epidote. The amphibole in slender prisms, faint straw-yellow / ferrous green; ext., 20°; strewn in various directions. The epidote in small, well-formed crystals, generally scattered; pleochroism canary-yellow / colourless. The quartz in small-grained



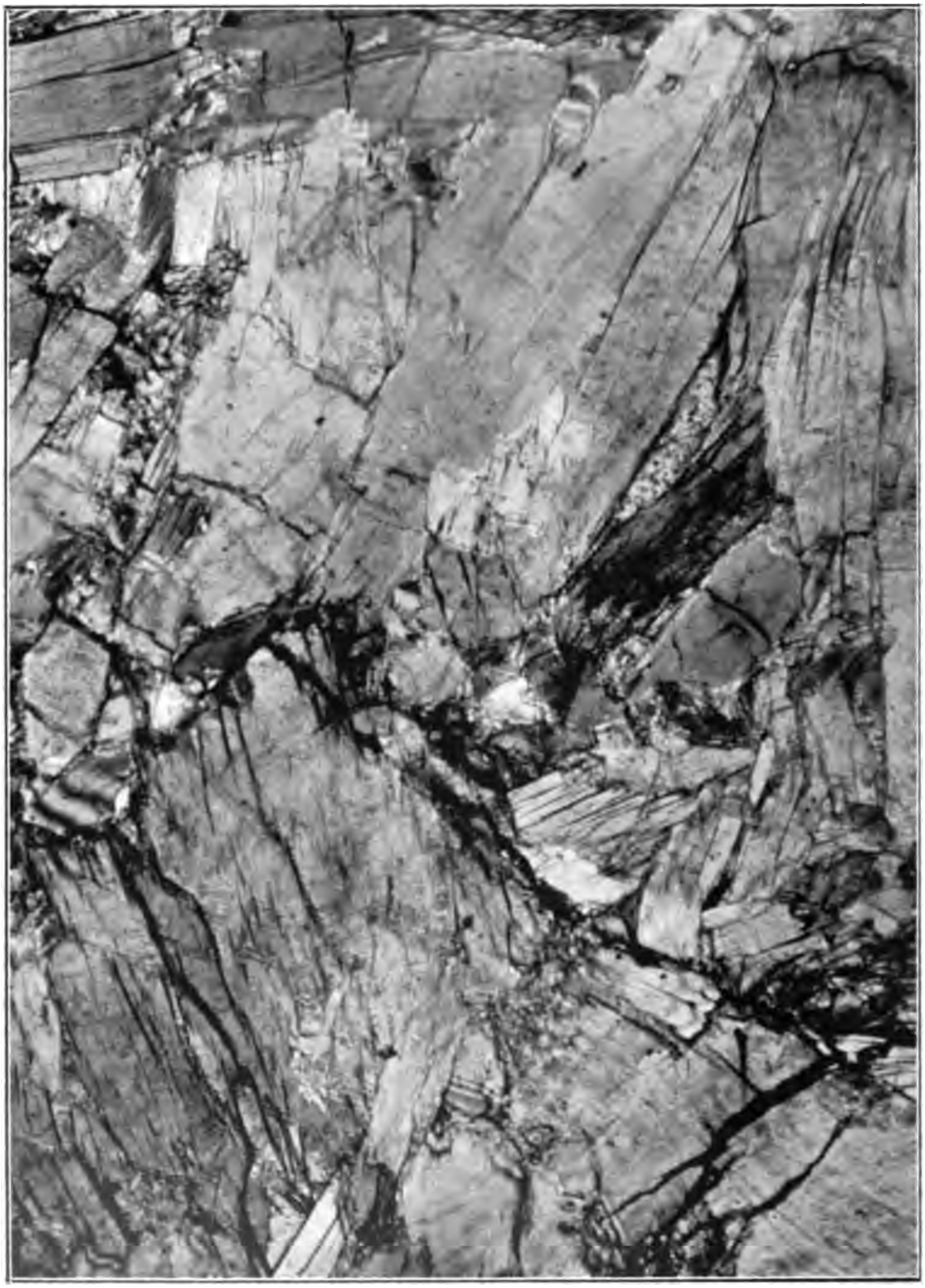
No. 495/1623. DOLOMITE TALC SCHIST.

[*To face p. 200, Vol. II.*

i.

No. 496/1631. AMPHIBOLE SCHIST.

[*To face p. 200, Vol. II.*
ii.



No. 498/1646. **AMPHIBOLE ROCK.**

[*To face p. 201, Vol. II.*

mosaics, and interstitial, quite subordinate in quantity. An occasional lenticle of calcite may be observed, containing amphibole and epidote in its marginal portion. A little chlorite is present.

Amphibole Epidote Schist.

Locality.—Arahura Valley, Westland.
Formation.—Middle division of the schists of Westland.
Remarks.—From the middle part of the second gorge of the Arahura River.

No. 498/1646.

M.C.—Green actinolite rock.

U.M.—Almost wholly consisting of amphibole, which is colourless under the microscope; ext., 21°; and frequently becomes asbestiform at the ends of the prisms. It is fairly clear generally, but much has a dusty appearance due to minute elongated irregular cavities and minute impurities, some of which may be magnetite. A little chlorite, straw-yellow / green, occurs interstitially. Here and there a grain of magnetite may be seen.

Amphibole Rock.

Illustration.—Slice shows good contrasts.
Photographed by polarised light; magnification, 33 diameters.
Locality.—Arahura Valley, Westland.
Formation.—Upper part of the middle division of the schists of Westland.
Remarks.—From the middle part of the second gorge of the Arahura River.

No. 499/1662.

M.C.—Rudely foliated with obvious amphibole.

U.M.—A granular mosaic of epidote, mostly colourless, sometimes yellowish; shot through with gerbs of amphibole prisms, which are colourless or pleochroic; straw-yellow / green / greenish-blue; ext., 14°; sign, +. These are evidently hornblende, with unusually blue pleochroism. A few grains of pyrites, scattered crystals of chlorite, straw-yellow / green, and a few small grains of quartz are present.

Hornblende Epidote Rock.

Locality.—Arahura Valley, Westland.
Formation.—Middle division of the schists of Westland.
Remarks.—The specimen is from the middle part of the second gorge of the Arahura River, the first in which solid rocks appear, the lower gorge being excavated in morainic deposit.

No. 500/4742.

M.C.—Talcose schist.

U.M.—A foliated aggregate of dolomite and talc, with radiating growths of serpentine. Sulphides are included in the dolomite, which is ferriferous.

Talc much resembles muscovite under the microscope, but in some cases is not dissimilar from serpentine.

Talc-dolomite Schist.

Locality.—Gorge of the Taipo River, Westland.
Formation.—Middle division of the schists of Westland.
Remarks.—This rock was reported gold-bearing, and samples from near the surface did contain gold. The specimen above described was taken from some depth below the surface, and an analysis showed no trace of gold. It is therefore concluded that in the previous case the gold was fine alluvial gold which had found its way some distance into the joints of the stone.

END OF VOL. II.

APPENDIX.

ANALYSES OF ROCKS OF CAPE COLVILLE PENINSULA.

PARTIAL ANALYSES AND DETERMINATIONS OF SILICA, POTASH, AND SODA. BY J. S. MACLAURIN, D.SC., F.C.S., COLONIAL ANALYST.

No.

27/2900. Spotted adinole, or grauwacke.
From Tiki Creek, Tiki-Tokatea district. (See Vol. I, p. 151.)
Contains silica, 60·81; potash, 2·92; soda, 1·69 per cent.

70/3216. Spotted adinole.
From the Hauraki Associated Mine, Tiki-Tokatea district. (See Vol. I, p. 181.)
Contains silica, 57·57; potash, 3·87; soda, 1·18 per cent.

72/3223. Spotted adinole, or fine-grained grit.
From the Pevril Mine, Tiki-Tokatea district. (See Vol. I, p. 183.)
Contains silica, 53·14; potash, 2·59; soda, 2·80 per cent.

84/3411. Adinole (?).
From No. 3 level, Royal Oak Mine, Tiki-Tokatea district. (See Vol. I, p. 191.)
Contains silica, 66; potash, 3·10; soda, 0·90 per cent.

111/3672. Dacite, or rhyolite.
From track, Gumtown to Upper Rangihau Valley. (See Vol. I, p. 209.)
Contains silica, 70·56; potash, 2·48; soda, 4·54 per cent.

112/3680. Glass, with plagioclase, augite, hypersthene, and hornblende.
From New Slip, Rangihau Valley, Gumtown district. (See Vol. I, p. 210.)
Contains silica, 68·14; potash, 2·62; soda, 3·28 per cent.

115/3697. Dacite rhyolite.
From New Slip, Rangihau Valley, Gumtown district. (See Vol. I, p. 212.)
Contains silica, 68·24; potash, 2·20; soda, 3·28 per cent.

125/3751. Rhyolite, with plagioclase.
From Upper Rangihau Valley, Gumtown district. (See Vol. I, p. 221.)
Contains silica, 72·56; potash, 2·58; soda, 4·36 per cent.

136/3825. Andesic pitchstone.
From Omahu Creek, Thames County. (See Vol. I, p. 230.)
Contains silica, 69·36; potash, 3·32; soda, 3·22 per cent.

192/4364. Pitchstone.
From Paku Island, Coromandel County. (See Vol. I, p. 272.)
Contains silica, 70·95; potash, 3·96; soda, 2·37 per cent.

193/4366. Pitchstone.
From Paku Island, Coromandel County. (See Vol. I, p. 273.)
Contains silica, 69·55; potash, 4·46; soda, 1·85 per cent.

207/3. Glassy rhyolite.
From Ruapehu Claim, Owharoa district. (See Vol. II, p. 3.)
Contains silica, 69·77 per cent.

No.
230/133. Spherulitic dacite, or rhyolite.
From Long Drive, Kinsella's Creek, Waitekauri district. (See Vol. II, p. 21.)
Contains silica, 65·72 per cent.
233/158. Pyroxene dacite.
From south side of Ohinemuri River at suspension bridge below Owharoa. (See Vol. II, p. 24.)
Contains silica, 63·95 per cent.
241/212. Spherulitic and glassy hornblende hypersthene dacite.
From Whangamata Track, Waihi district. (See Vol. II, p. 29.)
Contains silica, 60·62 per cent.
276/444. Altered andesite, or pyroxene rhyolite.
From Waihi-Silverton Mine, Waihi district. (See Vol. II, p. 53.)
Contains silica, 64·17 per cent.
278/452. Andesite pitchstone.
From Omahu Peak, Thames County. (See Vol. II, p. 54.)
Contains silica, 69·51 per cent.
296/534. Spherulitic hornblende dacite.
From Door Tunnel, Owharoa district. (See Vol. II, p. 68.)
Contains silica, 66·56 per cent.
297/541. Spherulitic hornblende pyroxene dacite.
From Door Tunnel, Owharoa district. (See Vol. II, p. 69.)
Contains silica, 66·09 per cent.
301/556. Glassy and spherulitic hornblende pyroxene dacite.
From Door Tunnel, Owharoa district. (See Vol. II, p. 71.)
Contains silica, 66·89 per cent.
304/612. Consolidated volcanic ash.
From Omahu Creek, Thames County. (See Vol. II, p. 74.)
Contains silica, 66·89 per cent.
334/732. Altered pyroxene andesite, or pyroxene rhyolite.
From Adelaide Claim, Una Hill, Thames district. (See Vol. II, p. 95.)
Contains silica, 49·37 per cent.
355/836. Altered pyroxene dacite, or pyroxene rhyolite.
From Tararu Creek, Thames district. (See Vol. II, p. 110.)
Contains silica, 67·06 per cent.
361/881. Volcanic ash, with lapilli.
From the Kauaeranga Valley, Thames County. (See Vol. II, p. 115.)
Contains silica, 62·31 per cent.
363/911. Perlitic glass.
From the Kauaeranga Valley, Thames County. (See Vol. II, p. 117.)
Contains silica, 71·77 per cent.
364/912. Perlitic glass.
From the Kauaeranga Valley, Thames County. (See Vol. II, p. 118.)
Contains silica, 71·09 per cent.
366/923. Rhyolite, or dacite rhyolite.
From the Kauaeranga Valley, Thames County. (See Vol. II, p. 119.)
Contains silica, 72·95 per cent.
373/995. Dacite.
From the Kauaeranga Valley, Thames County. (See Vol. II, p. 125.)
Contains silica, 72·95 ; potash, 2·46 ; soda, 4·14 per cent.
392/1172. Spherulitic dacite, or dacite rhyolite.
From Ruapehu Claim, Owharoa district. (See Vol. II, p. 137.)
Contains silica, 73·56 per cent.

INDICES.

INDEX TO MINERALS, VOLS. I AND II.

Actinolite—I, 144, 168, 169; II, 152, 174, 175, 188, 189, 192, 194, 196, 201.

Albite—I, 129, 134, 166, 257, 264, 275; II, 11, 151, 166, 169, 171, 179, 184.

Amphibole—I, 144, 171; II, 152, 153, 175, 187, 188, 189, 190, 191, 192, 193, 195, 197-201.

Analcime—II, 155, 176.

Andalusite—I, 176; II, 186, 198.

Andesine—I, 126, 135, 150, 216, 254; II, 13, 21, 28, 30, 32-35, 37, 44, 46, 50, 53-57, 60, 62, 66-69, 71, 74, 76, 78, 79, 83, 85-88, 90-93, 99, 100, 103, 109, 110, 111, 124, 125, 129, 130-34, 136, 137, 140, 142, 144, 146, 150, 155, 160, 161-63, 165-68, 172, 174, 175, 181, 193.

Anorthite—I, 134.

Anorthoclase—II, 19.

Apatite, I, 127, 131, 133, 139, 141, 142, 144, 145, 147, 148, 150, 159, 161-66, 168, 170-73, 175, 177, 182, 184, 187-89, 197, 199-202, 210-15, 227, 228, 230, 233-35, 237, 238, 240, 248, 251, 252, 255, 279, 280; II, 2, 4, 11, 13, 14, 17-24, 28, 39, 40, 42, 44, 45, 49, 50, 52, 54, 59, 60, 63, 67-69, 87, 88, 90, 91, 94, 95, 108, 109, 115, 116, 118, 120, 123, 124, 128-30, 132, 137, 140, 143, 146, 155, 159-61, 165, 166, 170, 171, 176, 177, 182, 184, 185, 188.

Augite—I, 127, 134, 135, 137, 139, 140, 141, 143, 145, 146-48, 153, 159, 163, 167, 169, 172-74, 182, 190-92, 196-200, 202, 204-7, 210-12, 214, 219, 220, 227, 228, 231, 233-38, 246-55, 257, 260, 262, 267, 268, 276, 277; II, 4, 6-8, 11-14, 21, 23, 28, 30, 31, 33, 34, 38, 42, 44, 45, 50-52, 55, 56, 59-62, 67, 75, 78-83, 85-87, 92-94, 99, 100, 103, 107, 109, 111, 115, 116, 118, 124, 125, 127, 129-33, 136, 139, 142, 143, 145, 151, 153-55, 159-63, 165-68, 175-77, 194.

Barkevicite—II, 12.

Bastite—I, 159, 172; II, 11, 13, 38, 50, 52, 59, 62, 123, 125, 126, 132-38, 151, 155, 159, 160.

Biotite—I, 141, 147, 152, 156, 163, 170, 175, 187, 193, 195, 196, 199, 210, 217, 220, 222, 236, 241-46, 254, 255, 257-61, 263, 265, 268, 272, 275, 276; II, 2, 4, 5, 11, 13, 14, 22, 26, 31, 46, 69, 74, 101-3, 105, 107, 113, 119, 120, 123, 125, 126, 132-38, 152, 153, 162, 166, 169-71, 176, 179, 181-86, 188, 189, 191-98.

Calcite—I, 194, 201; II, 8, 20, 49, 77, 139, 152, 154, 160, 167, 168, 176, 178, 180-85, 192, 196, 201.

Chalcedony—I, 279; II, 39, 122, 137.

Chlorite—I, 119, 127, 129, 131-33, 138-45, 147-49, 152-62, 168, 169, 171, 172, 174, 176, 177, 181-87, 189, 193, 196, 201, 202, 205, 206, 208, 209, 220, 226, 227, 238, 239, 243, 247, 250, 253; II, 7, 9, 10, 13, 17, 18, 20-22, 24, 25-27, 29, 32, 34, 37-40, 43-55, 57, 58, 60-64, 67, 75-99, 106, 107, 109, 110, 115, 119, 121, 130, 131, 139, 141-44, 153-55, 170-72, 174, 177-81, 183, 184, 190, 191, 193, 196, 201, 202.

Chlorophæite—I, 198, 203; II, 23.

Chromite—II, 114, 194, 200.

Clinoclase—II, 97, 109, 110, 130, 154.

Crysotile—I, 128, 172, 189.

Diallage—II, 177.

Delessite—I, 226; II, 108.

Dolomite—II, 75, 152, 153, 190, 197, 199-202.

Enstatite—I, 146, 172; II, 59.

Epidote—I, 119, 127, 129, 131-33, 138-45, 152, 153, 166-71, 174, 177, 182, 184, 194, 206, 237, 250, 253, 255; II, 22, 29, 79, 87-90, 92, 93, 95, 106, 152, 153, 171, 176-79, 180-82, 184, 187, 189, 191, 193, 196, 197, 201.

Felspar—I, 123, 126-60, 162-69, 171-77, 179-82, 184-202, 204-13, 215-25, 227, 228, 230-32, 234-41, 243, 244, 246-53, 254, 257, 259-69, 271, 272, 275-80; II, 1, 3, 4, 6-40, 42-72, 74-103, 105-16, 118-20, 123, 125-33, 136-46, 153, 154, 160-72, 174, 176, 178-82, 184, 185.

Garnet—II, 152, 153, 186, 188, 189, 191, 193-95, 198, 199.

Glauconite—II, 174.

Heulandite—I, 149, 150.

Hornblende—I, 119, 123, 127, 128, 131-33, 135, 137-48, 150, 152, 153, 156-59, 161-64, 166, 168-74, 176, 177, 182, 187-89, 192, 196-202, 204-6, 208, 211, 219, 220, 236-38, 240, 241, 246, 248-50, 252, 255, 270; II, 2, 4, 5, 8, 10, 12, 14, 15, 19-21, 23, 24, 27, 29, 30, 34, 40, 41, 50, 51, 59, 61, 63, 64, 67-71, 76, 80-82, 85, 87, 90-94, 96, 98-100, 103, 106, 107, 109-11, 114-18, 120, 124, 130-33, 136, 137, 140-43, 150, 151, 153, 156, 159-62, 172, 174-77, 185, 202.

Hyalite—II, 145.

Hyalophane—I, 120.

Hydrophite—II, 154.

Hypersthene—I, 131, 135, 137, 140, 141, 143, 145-48, 150, 153, 154, 157, 159, 161, 163, 165-67, 172-74, 188, 190-92, 197-200, 202, 204-7. 210-12, 214, 219, 220, 227, 228, 231, 233-39, 242, 244, 248-54, 268; II, 2, 4, 6-8, 11-15, 17, 19, 23, 28, 30-33, 38, 42, 44, 45, 47, 50-52, 55, 56, 59, 61, 62, 67, 69, 75, 78-81, 83-87, 91-94, 99, 100, 107, 109, 111, 116, 118, 124, 125, 127, 129-33, 136, 137, 139, 142-46, 149, 150, 153, 154, 160, 162-66.

Ilmenite—I, 127-29, 131, 133, 135, 137-45, 148, 155, 156, 159, 161-66, 169-71, 174, 178, 181, 182, 184, 187, 188, 200, 212, 216, 222, 228, 229-231, 233, 236, 237, 242, 250, 252, 255; II, 2, 5-7, 9, 10, 17, 18, 20-22, 25, 27-29, 32-34, 36, 38, 40, 41, 45, 47-50, 52-55, 58, 68, 70, 77, 84, 88-90, 92, 94-96, 98, 106, 110, 112, 116, 120, 123, 128, 130, 131, 140-42, 168, 171, 174, 179.

Kaolin—II, 18, 49, 53, 64, 80, 81, 85, 89, 94-97, 105, 107, 110, 130.

Labradorite—I, 125, 126, 134, 210, 254; II, 2, 4–6, 8, 9, 11–13, 21, 23, 28–31, 34, 37, 44, 51, 55, 60–62, 67, 75, 79, 81, 83, 87, 88, 90, 92, 93, 99, 103, 107, 109, 110, 115, 116, 124, 141, 143–45, 159, 163, 165, 167, 168, 175.
Leucoxene—I, 127–29, 131, 133, 136–40, 142, 143, 145, 152–63, 165, 166, 168–74, 176, 177, 181, 182, 184, 186–89, 196, 200–2, 204–8, 218, 223, 225, 227, 230, 231, 233, 236, 239, 240, 242, 244, 247, 250–53, 267, 268; II, 4, 7, 9–11, 16–20, 22, 24–29, 32–34, 36–41, 43–45, 47–50, 52–54, 56–58, 60, 63, 64, 67, 68, 70, 72, 74, 76, 78, 80–82, 84, 86, 88–90, 92–98, 106–11, 128, 130, 131, 139–45, 147, 171, 172, 176, 178–82.
Magnetite—I, 133–35, 137–48, 150, 152, 153, 158–63, 167–69, 171–76, 190–92, 197–216, 218–21; II, 2, 4–7, 9–14, 19, 21–29, 30–35, 37, 38, 42, 44, 46, 49–51, 55, 56, 59, 61–63, 66–71, 74–76, 78–88, 90–93, 96–100, 103, 106, 107, 109–11, 115–19, 122–33, 136, 137, 139–46, 152–55, 159–69, 171–73, 176–80, 182–86, 188–92, 194, 195, 197–201.
Menilite—I, 154.
Mica—I, 242; II, 40, 45, 49, 52, 53, 58, 64, 76, 80, 81, 88, 97–99, 109–11, 134, 135, 141, 151–53, 172, 186, 187, 189, 192, 195, 196.
Microline—II, 166.
Microperthite—I, 125, 126, 223; II, 18, 54, 70, 72, 113, 128, 129, 159, 173, 178, 182, 183, 185.
Muscovite—I, 128, 132, 136, 140, 141, 143, 155, 161, 165, 175, 179, 180, 185, 193, 208, 225, 250, 252, 254, 268; II. 4, 18, 24, 27, 29, 39, 40, 48, 49, 52, 67, 82–85, 151, 159, 166, 170, 173, 184, 186, 187, 189, 191, 200, 202.
Natrolite—II, 155.
Nepheline—II, 97.
Obsidian—II, 126.
Olivine—I, 125, 204, 249; II, 31, 32, 34, 151, 153, 154, 160, 167, 168, 176, 186, 187, 190, 193, 199, 200.
Oligoclase—I, 125, 126, 135, 216, 267; II, 35, 46, 50, 56, 66, 68, 69, 74, 87, 130, 132, 134, 146, 169, 171, 172, 174, 181, 193.
Omphacite—II, 176.
Opal—I, 124, 163, 270, 280; II, 65, 66, 116, 121, 137, 145, 146.
Orthoclase—I, 125, 126, 129, 135, 152, 161, 162, 166, 171, 176, 177, 193, 196, 215, 223, 237, 244, 254, 255, 262, 269, 275; II, 11, 17, 18, 36, 38–40, 45, 54, 58, 63, 64, 67, 71, 72, 83, 95, 98, 99, 102, 103, 112, 132–34, 155, 159, 169, 171–73, 179, 181–85, 193.
Palagonite—II, 168.
Pennine—I, 140, 141, 159, 162, 166, 171, 177, 184, 187, 202, 204, 239; II, 17, 18, 52, 58, 61, 81, 84, 85, 90, 92, 94–96, 106, 109, 110, 130, 139, 141, 144.
Picolite—II, 185, 194, 199.
Plagioclase—I, 119, 125, 128, 129, 132–35, 137, 138–48, 151–54, 156–59, 161, 163–74, 176, 177, 182, 187–93, 195–207, 210–14, 216, 217, 219–22, 224, 226–30, 233–38, 241, 242, 244, 245, 248–54, 267, 270, 272, 278, 279; II, 2, 4–15, 19–24, 26, 28–47, 50–57, 59–62, 66–69, 71, 74–76, 79–89, 91–95, 97–100, 102, 103, 106, 107, 109–11, 113–16, 118–20, 123–46, 150, 151, 153–56, 159–85, 193.
Potash—II, 17.
Pumice—I, 239; II, 15, 26, 43, 53, 74, 103, 116, 138, 164, 166, 169, 170.
Pyrites—I, 127, 129–31, 133, 135, 141, 143, 144, 152, 155, 156, 158–61, 166, 175–77, 179, 181, 182–86, 196, 201, 208, 223, 225, 231, 238, 240, 247, 250–52, 269; II, 4, 7, 9, 11, 16–19, 22, 24, 26, 28, 29, 37, 38, 40, 41, 44, 45, 49, 50, 53, 54, 60, 63, 64, 67, 68, 70, 72, 77, 89, 97, 98, 107, 108, 110, 111, 128, 130, 141, 145, 153, 171, 173, 175, 178, 182, 185–87, 192, 195, 197, 200, 202.
Pyroxene—I, 128, 129, 131–35, 137–48, 151, 153, 154, 156–60, 162–65, 167–69, 171–74, 177, 181, 182, 187–90, 197–99, 201–3, 205–7, 209, 212–14, 216, 217, 219–21, 225, 231, 233–41, 242, 244, 247–52, 255, 262, 270, 272, 276, 278, 280; II, 2, 4–12, 16–40, 42–50, 52–64, 67–69, 71, 72, 74, 76, 77, 79, 81–100, 106–11, 115–19, 123, 127–33, 136, 137, 139–42, 144–46, 150, 151, 153, 163, 165, 171, 172, 176, 177, 181, 185.
Quartz—I, 118, 119, 122–24, 127–33, 135–45, 147, 150–53, 155–62, 164–72, 174–87, 189, 191, 193–97, 200–4, 206, 208–10, 213, 216, 218, 222–26, 229–31, 237–42, 249–61, 263–65, 267–70, 272, 274–79; II, 1, 2, 4, 5, 7, 9–11, 14–22, 24–41, 43–61, 63, 64, 67–72, 74–84, 87–117, 119–25, 128–30, 132–38, 140, 143–47, 150, 152, 163, 164, 166, 169–89, 191–98, 201, 202.
Rutile—I, 158, 159; II, 173.
Sanidine—I, 195, 215, 221, 230, 231, 241, 243, 257–59, 261, 264, 266, 270, 275; II, 134, 135, 164.
Sericite—I, 122, 128, 129, 135–37, 156–62, 165, 166, 170, 176–81, 184–86, 196, 201, 208, 225, 231, 239, 240, 247, 250–52, 267–69; II, 47, 196.
Serpentine—I, 148, 158, 159, 163, 165, 166, 172, 188, 197, 199–203, 205–7, 213, 216, 228–30, 233, 237, 238, 246; II, 22, 32, 33, 46, 54, 59, 61, 62, 69, 78, 85–87, 98, 107, 118, 119, 127, 136, 140, 142, 152–54, 160, 167, 168, 174, 185, 187–90, 192, 195, 197, 199, 202.
Smaragdite—II, 177.
Soda—II, 17, 54, 70, 72.
Sphene—I, 141, 155, 159, 200, 242, 255; II, 9, 10, 18, 34, 63, 123, 130, 159, 166, 170, 172, 174, 177, 179, 183–86, 193.
Stilbite—II, 128.
Talc—II, 152, 153, 187, 189, 190, 200, 202.
Tacylite—II, 129.
Tremolite—II, 152, 153, 189, 190, 192, 195, 196, 198, 199.
Tridymite—I, 122, 211, 213, 215, 217, 220, 230, 232, 236, 243, 244, 246, 256–66, 271, 272, 274–79; II, 12, 14, 21, 28, 30, 31, 56, 59, 73, 101, 105, 119, 121.
Uralite—I, 139, 169.
Uiridite—I, 169, 171.
Xylotile—I, 135.
Zeolite—I, 148–50, 226; II, 121, 128, 155, 176.
Zircon—I, 127, 129, 132, 137, 152, 158, 170, 171, 177, 179, 222, 225, 227, 233, 238, 246, 254, 267; II, 11, 15, 19, 32, 67–69, 72, 87, 102, 129, 146, 147, 159, 164–66, 170, 171, 173, 183, 185, 186.
Zoisite—I, 132, 207; II, 177, 181, 184, 187, 191, 197.

INDEX TO LOCALITIES, VOLS. I AND II.

Adams's Farm, Moehau district, Coromandel County—I, 255.
Adelaide Claim, Thames district and County—I, 47; II, 76, 84, 85, 89, 95, 98, 99.
Adelaide Mine, Thames district and County—I, 45, 49; II, 96.
Amaranth Reef, Silverton Hills, Ohinemuri County—II, 17.
Amuri district, Nelson—II, 150, 167–69.
Arahura River, Westland—II, 11, 187–89, 191, 192, 194, 195, 197–201.
Arahura Valley, Westland—II, 152, 153, 191–201.
Arahura Wahininini—II, 187.
Ascot Terrace, Paeroa district, Ohinemuri County—I, 102; II, 10.
Auckland—II, 150, 151, 158, 174–78.
Austral Hill, Cabbage Bay district, Coromandel County—I, 51, 70, 173.
Bay of Plenty—I, 27, 29, 30; II, 11, 127.
Big Beetle Claim, Gumtown-Rangihau district, Thames County—I, 220.
Big Beetle Mine, Gumtown-Rangihau district, Thames County—I, 223, 224.
Big Dam, Tairua Valley, Thames County—I, 101, 245; II, 103.
Big Slip, Gumtown-Rangihau district, Thames County—I, 222, 227.
Billy-goat Falls, Kauaeranga district, Thames County—I, 96.
Billy-goat Stream, Kauaeranga district, Thames County—I, 96; II, 120.
Black Hill, Waihi district, Ohinemuri County—I, 110; II, 14.
Black Jack, Kuaotunu district, Coromandel County—I, 40, 84, 203.
Blackstone Creek, Opitonui district, Coromandel County—I, 45, 47, 205.
Blind Bay, Great Barrier Island—I, 56; II, 146.
Boardinghouse Creek, Owharoa district, Ohinemuri County—II, 22, 65, 66.
Brancepeth, east coast of Wellington—II, 149, 155–57.
Britannia Mine, Kapanga district, Coromandel County—I, 51–53, 155, 156, 158, 160, 161; II, 141, 144.
Brocken, The, Range, Brancepeth, east coast of Wellington—II, 155.
Broken Hills, Tairua-Wharekawa district, Thames County—I, 45, 50, 61, 91, 96, 267–69.
Broken Hills Mine, Tairua-Wharekawa district, Thames County—I, 61.
Brown's Camp, Kuaotunu district, Coromandel County—I, 56, 200.
Bullion Creek, Tapu Creek, Thames County—I, 254.
Buller Gorge, Nelson—II, 159.
Bull's Run, Gumtown-Rangihau district, Thames County—I, 222.
Bunker's Hill, Kapanga district, Coromandel County—I, 51, 147.
Buffalo Claim, Tiki-Tokatea district, Coromandel County—I, 48, 50, 161.
Buffalo Mine, Tiki-Tokatea district, Coromandel County—I, 162.
Cabbage Bay, Coromandel County—I, 8, 14, 26, 27, 31, 39, 40, 43, 50, 54, 56, 57, 67, 68–70, 97, 163.
Cabbage Bay district, Coromandel County—I, 165, 173, 175.
Cabbage Bay, South Head, Coromandel County—I, 164.
Cadman's Creek, Tiki-Tokatea district, Coromandel County—I, 38, 39, 72, 76, 77, 131–33, 136, 139, 143, 144.
Caledonian Mine, Thames district, Thames County—I, 8, 46.
Cape Colville, Coromandel County—I, 31, 122.
Cape Colville district—I, 27.
Cape Colville Peninsula—I, 1, 3, 5–11, 16, 26, 28, 29, 32–34, 36, 37, 39, 42, 59, 64, 67, 69, 75, 81, 96, 113, 114, 117, 119, 152, 194, 204, 279; II, 68, 109.
Cape Foulwind, Nelson—II, 150, 159
Cape Runaway—I, 29; II, 177.
Cascade Creek, Te Aroha district. Ohinemuri County—I, 45, 47, 249–51, 253.
Castle Progress Mine, Waiau, &c., district, Coromandel County—I, 80.
Castle Rock, Waiau, &c., district, Coromandel County—I, 13, 14, 52, 80, 82, 140, 145, 146, 150, 153, 206; II, 143.
Central Otago—II, 158.
Cheviot Coast Range, Cheviot County, Amuri district, Nelson—I, 36, 37, 81; II, 150, 169, 170–73, 184.
Cheviot Hills, Amuri district, Nelson—II, 150, 170–73.
Chicago Claim, Thames district, Thames County—I, 48.
Chicago Mine and Reef, Tararu Creek, Thames County—II, 89, 111.
Collarbone Gully, Thames district, Thames County—II, 76, 95.
Cook County—II, 11.
Coromandel—I, 1–8, 13, 26, 45, 51, 68, 75, 77, 80, 82, 129, 130, 136, 142, 144, 184, 193, 206–8, 215; II, 50.
Coromandel County—I, 5, 26, 44, 57, 151, 188, 205, 209, 256–64, 266, 271–78, 280–82; II, 50.
Coromandel district—I, 8, 194.
Coromandel Goldfields—I, 8, 28, 183.

Coromandel Harbour—I, 1, 6, 7, 26, 31, 36, 37, 40-42, 50, 54, 56, 65, 72, 74, 79-81, 127, 148, 160, 190, 194-96.

Coromandel - Te Kouma and Manaia district, Coromandel County—I, 190; II, 169.

Coromandel Township, Kapanga district, Coromandel County—I, 72, 145.

Courthouse Creek, Tiki-Tokatea district, Coromandel County—I, 77, 161, 162.

Crowbar Gorge, Arahura River, Westland—II, 187.

Crown Battery, Karangahake district, Ohinemuri County—II, 6, 37.

Crown Mines (N.Z.), Karangahake, Ohinemuri County—I, 48.

Cumming's, Owharoa district, Ohinemuri County—II, 34.

Dacre's Hill, Kapanga district, Coromandel County—I, 146.

Dead Horse Gully, Moonlight Creek, Lake County, Otago—II, 150, 158.

Deep Sinker Claim and Mine, Thames district, Thames county—I, 48; II, 86.

Docherty's Creek, Paeroa, &c., district, Ohinemuri County—I, 55; II, 9.

Doctor's Gorge, Waipara River, Canterbury—II, 150, 160.

Door Tunnel, Owharoa district, Ohinemuri County—I, 52, 53; II, 69, 71, 72.

Driving Creek, Kapanga district, Coromandel County—I, 1, 156, 159, 160.

Dun Mountain, Waimea County, Nelson—I, 9, 36.

Dun Mountain, Mineral Belt, Waimea County, Nelson—II, 186.

Dun Mountain Range, Waimea County, Nelson—II, 151, 186.

East Cape district, Auckland—II, 177.

Egmont, Mount—II, 160.

Firth of Thames, Auckland—I, 1, 29, 60, 94, 96.

Flat Point, East Coast of Wellington—II, 149, 154, 155.

Four Gates, Leader Valley, Amuri district, Nelson—II, 169.

Fourth Branch, Tairua - Wharekawa district, Thames County—I, 50, 58, 65, 91.

Fraser's Dam, Tiki-Tokatea district, Coromandel County—I, 139.

Gloucester Claim, Thames district, Thames County—I, 47, 48, 49; II, 76, 77, 84.

Golden Fleece Claim and Mine, Karangahake district, Ohinemuri County—I, 49; II, 41.

Golden Pa Claim and Mine, Kapanga district, Coromandel County—I, 53, 131.

Gorge of Taipo River, Teremakau Valley, Westland—II, 151, 200.

Gorge of the Hokitika River, Westland—II, 194, 200.

Gorge of the Waipaoa River, Poverty Bay, Auckland—II, 174-78.

Graham's Creek, Paku Island district, Coromandel County—I, 89.

Grahamstown Flat, Thames district, Thames County—I, 93.

Grand Junction Mine, Waihi district, Ohinemuri County—I, 51, 52; II, 17, 18, 60, 61, 139.

Great Barrier Island—I, 26, 29, 56; II, 146.

Gumtown, Coromandel County—I, 55, 58, 59, 86, 88, 111, 226, 227.

Gumtown district, Coromandel County—60-64, 66, 210-21, 223-25; II, 104, 128.

Hamilton Range, Waipara district, Canterbury—II, 160.

Hape Creek, Thames district, Thames County—I, 9, 47, 93; II, 80, 82, 83, 87, 100, 111.

Harataunga Gorge, Tiki-Tokatea district, Coromandel County—I, 180.

Harataunga Stream, Tiki-Tokatea district, Coromandel County—I, 178.

Harbour View Claim, Tiki-Tokatea district, Coromandel County—I, 184-86.

Hastings, Tapu Creek, Thames County—I, 31, 92, 249.

Hauraki Associated Claim and Mine, Tiki-Tokatea district, Coromandel County—I, 38, 182, 183.

Hauraki district, Kapanga district, Coromandel County—I, 7, 9.

Hauraki Goldfields—I, 3, 4-9, 31, 50, 70, 80, 208.

Hauraki Gulf—I, 29, 30, 40, 52, 55, 60, 69, 72, 93, 146, 237, 255; II, 150, 158.

Hauraki Mine, Kapanga district, Coromandel County—I, 3, 52, 53, 60, 130, 141.

Hauraki North Mine, Kapanga district, Coromandel County—I, 157, 158.

Hauraki South Mine, Kapanga district, Coromandel County—I, 52, 128.

Hauraki Peninsula—I, 7, 28.

Hautotara Mountains, Wellington—II, 179-85.

Hihi River or Stream, Kauaeranga district, Thames County—I, 97; II, 114, 115, 119, 120, 122.

Hikurangi district, Tauranga County—I, 56.

Hikurangi Mountain, Cook County—II, 177.

Hikurangi Mountain, Tauranga County—I, 59, 62, 113, 114; II, 132, 133.

Hikutaia district, Thames and Ohinemuri Counties—I, 53, 60-64, 101, 244-46.

Hikutaia River and Stream, Thames and Ohinemuri Counties—I, 15, 29, 58-60, 101, 114, 242-44; II, 134, 135.

Hikutaia Township, Valley, and watershed, Thames and Ohinemuri Counties—I, 66; II, 52, 65, 101-4, 133, 135, 136.

Hokitika River and Gorge, Westland—II, 152, 153, 189, 190, 195.

Hooker's, Mahakirau district, Coromandel County—I, 57; II, 130, 131.

Hot-water Beach, Mercury Bay district, Coromandel County—I, 60, 86, 209

Hurunui Plain—II, 160.

Imperial Mine, Karangahake district, Ohinemuri County—I, 49; II, 58.

Jackson's, Teremakau Valley, Westland—II, 152, 196.

Kaimanawa Mountains, Wellington — II, 150, 163-66.

Kaimarama River, Mahakirau district, Coromandel County—I, 85.

Kapai-Vermont Claim, Kuaotunu district, Coromandel County—I, 55, 203.

Kapanga, Coromandel County—I, 1, 34, 44, 50-53, 72, 75, 79, 128-31, 134, 135, 137, 140-42, 145-48, 154-58.

Kapanga Flat, Kapanga district, Ohinemuri County—I, 72, 73, 76.
Kapanga Hill, Kapanga district, Coromandel County—I, 100.
Kapanga Mine, Kapanga district, Coromandel County—I, 1, 72, 154, 158, 160, 165, 166.
Kapanga Stream and Valley, Kapanga district, Coromandel County—I, 60, 72, 217-19.
Kapowai Stream, Gumtown-Rangihau district, Coromandel County—I, 60, 215, 222, 223.
Kapowai No. 2 Claim, Gumtown-Rangihau district, Thames County—I, 218, 223, 225, 226.
Kapowai Mine, Gumtown-Rangihau district, Thames County—I, 61.
Karaka Creek, Thames district, Thames County—I, 47, 48, 93, 94; II, 44, 76, 77, 81, 82, 84, 85, 89, 95, 100.
Karangahake, Ohinemuri County—I, 2, 45, 49, 55, 56, 103.
Karangahake district, Ohinemuri County—I, 46, 48, 49, 72, 104, 106, 125; II, 6, 8-10, 23, 25, 27, 39, 40, 45-49.
Karangahake Gorge, Ohinemuri River, Ohinemuri County—II, 25.
Karangahake Mountain, Ohinemuri County—I, 12, 45, 46, 55, 104, 106; II, 7, 24, 27, 36, 41, 58, 72.
Karangahake Township, Ohinemuri County—I, 104, 109; II, 7, 12, 13, 37, 38.
Kathleen Crown Mine, Kapanga district, Coromandel County—I, 51, 140.
Kathleen Mine, Kapanga district, Coromandel County—I, 53, 142.
Katikati, Tauranga County—I, 109, 114.
Kauaeranga, Thames County—I, 66.
Kauaeranga district, Thames County—I, 57, 60-62, 64, 66.
Kauaeranga River, Valley, and watershed, Thames County—I, 1, 30, 32, 55, 57, 58, 60, 62-65, 93, 94, 97, 98; II, 93, 104-6, 111, 113-22, 125.
Kennedy's Bay, Tiki-Tokatea district, Coromandel County—I, 31, 35, 39, 50, 57, 70, 75, 76, 137, 138, 178, 180; II, 140, 143, 145.
Kinsella's Creek, Waitekauri district, Ohinemuri County—I, 108; II, 22.
Kivin's Point, Kapanga district, Coromandel County—I, 72.
Kikowhakarere Bay, Kapanga district, Coromandel County—I, 51-53, 145-54.
Kirita Bay, Coromandel to Manaia district, Coromandel County—I, 39, 54, 190; II, 144.
Klondike Claim, Omahu district, Thames County—I, 60, 232.
Kuaotunu, Coromandel County—I, 2, 33, 39, 55, 56, 75, 82, 83, 136, 200, 203.
Kuaotunu Creek, Kuaotunu district, Coromandel County—I, 36, 83.
Kuaotunu Goldfields, Kuaotunu district, Coromandel County—I, 9, 40.
Kuaotunu - Mercury Bay Road, Coromandel County—I, 200.
Kuaotunu, Peninsula, Coromandel County—I, 55.
Kuaotunu Valley, Coromandel County—I, 83.
Kurinui-Caledonian Mine, Thames district, Thames County—II, 110.
Kurinui Creek, Thames district, Thames County—I, 93.
Lake Taupo—II, 11, 123, 127.
Lake Te Anau, Otago—I, 36.
Lake Wakatipu, Otago—I, 36.
Landward Sugar-loaf, New Plymouth, Taranaki—II, 162.
Leader Valley, Amuri district, Nelson—II, 150, 169.
Longdrive, Ohinemuri Syndicate's Claim, Waitekauri district, Ohinemuri County—I, 53.
Longwood Range, Southland—I, 36.
Lookout Rocks, Thames district, Thames County—I, 93.
Mackaytown, Paeroa, &c., district, Ohinemuri County—I, 33, 55, 102, 103; II, 12, 13, 23.
Madden's Folly Claim, Owharoa district, Ohinemuri County—I, 53; II, 65.
Mahakirau River, Coromandel County—I, 57, 85; II, 130, 131.
Maiden Mine, Opitonui district, Coromandel County—I, 47, 49, 207, 208.
Maitai Valley, Nelson—I, 39.
Manaia, Coromandel County—I, 26, 50, 79.
Manaia Flat and district, Coromandel County—I, 74, 193.
Manaia Harbour—I, 26, 31, 36, 37, 41, 42, 54, 56, 74, 80, 81, 152, 193-96.
Manaia River, Coromandel County—I, 39, 41, 79, 187, 188.
Mandamus Valley and River, Amuri district, Nelson—II, 160, 161.
Mangamaire Ridge, Kaimanawa Mountains, Wellington—II, 150, 163, 165, 166.
Mangamaire Stream, Kaimanawa Mountains, Wellington—II, 150, 164.
Maratoto Creek, Hikutaia district, Ohinemuri County—I, 53; II, 52.
Maratoto Peaks, Hikutaia district, Ohinemuri County—I, 101, 244.
Maria Lode, Woodstock Mine, Karangahake district, Ohinemuri County—II, 39.
Marsh's Farm, Tairua - Wharekawa district, Thames County—I, 59, 61; II, 146.
Martha Hill, Waihi district, Ohinemuri County—I, 111; II, 18, 51, 59, 63, 64, 67, 139.
Martha Royal Mine, Tapu Creek, Thames County—I, 92, 249.
Mason River, Amuri district, Nelson—II, 150, 167, 168.
Mata River, Thames County—I, 40, 41, 50, 54, 92, 237-40.
Mata Valley, Cook County, Auckland—II, 177.
Matarangi (or Materangi), Coromandel County—I, 57, 85.
Matarangi Bluff, Coromandel County—I, 56, 198, 199.
Matarangi district, Coromandel County—I, 56, 57, 82-84, 137, 197-99, 204; II, 141.
Matarangi Hill, Matarangi district, Coromandel County—I, 56, 137, 198, 204.
Matarangi Peak, Matarangi district, Coromandel County—I, 83.
Matawai, Waiau, &c., district, Coromandel County—I, 150.
Matawai River and Valley, Waiau, &c., district, Coromandel County—I, 13, 14, 41, 80; II, 143.
Matawai-Waiau Junction, Waiau, &c., district, Coromandel County—I, 47.

Matawai watershed, Waiau, &c., district, Coromandel County—I, 79.
Mercury Bay, Coromandel County—I, 29, 55, 58-60, 63, 65, 79, 82-86, 111, 209; II, 104, 127, 131, 140.
Mill Creek, Waiau, &c., district, Coromandel County—I, 80.
Mill Creek, Gumtown-Rangihau district, Coromandel County—I, 65, 80, 85.
Moanataiari Creek, Thames district, Thames County—I, 93.
Moanataiari Tunnel, Thames district, Thames County—I, 46; II, 109.
Moehau, Coromandel County—I, 8, 14, 29, 31, 40, 50, 64, 67, 68, 70, 80.
Moehau district, Coromandel County—I, 26, 31, 40, 41, 44, 65, 67, 69, 167-72, 174.
Moehau Mountain, Coromandel County—I, 255.
Monowai Claim and Mine, Thames County—I, 47, 50, 239.
Moonlight Creek, Lake County, Otago—II, 150, 158.
Mount Cookson, Amuri district, Nelson—II, 167-69.
Mount Egmont, Taranaki—II, 160, 161.
Mount Ruapehu, Wellington—II, 160.
Mount Turiwhate, Teremakau Valley, Nelson—II, 193.
Murphy's Hill, Matarangi district, Coromandel County—I, 57, 197.
Neavesville, Tairua-Wharekawa district, Thames County—I, 45, 50, 59, 66, 91, 98.
Nelson—I, 36; II, 161, 170-73.
New Plymouth, Taranaki—II, 150, 161, 162.
New Slip, Gumtown-Rangihau district, Thames County—I, 60-64, 211, 213, 214, 216.
New Zealand Crown Mines, Karangahake district, Ohinemuri County—II, 23, 47-49, 58.
Ngapuketurua Mountain, Hikutaia district—I, 101.
Ngaruroro River, Kaimanawa Mountains, Wellington—II, 150, 164.
North Star Claim, Thames district, Thames County—I, 46, 48.
North Star Tunnel, Thames district, Thames County—II, 97, 100.
Nutt Tunnel, Owharoa district, Ohinemuri County—II, 26.
Ohinemuri County—I, 35, 53, 54, 58, 63, 244; II, [illegible], 25.
Ohinemuri district—I, 2; II, 34.
Ohinemuri Gorge, Karangahake district, Ohinemuri County—I, 30, 48, 103, 104; II, 7, 25.
Ohinemuri Plain, Upper, Ohinemuri County—I, 106, 107-9, 111, 113; II, 15, 16, 31, 35, 41, 47, 53, 139.
Ohinemuri River and Valley—I, 29, 30, 55, 56, 59, 102, 104, 106, 109, 110; II, 5-7, 16, 22-24, 38, 43, 47, 53, 65, 72, 137.
Ohinemuri Syndicate's Mine and Shaft, Owharoa district, Ohinemuri County—II, 70, 72.
Ohio Creek, Thames district, Thames County—I, 93.
Ohui, Tairua-Wharekawa district, Thames County—I, 61, 63, 90, 91, 270; II, 147.
Okuku watershed, Canterbury—II, 161.
Old workings, Owharoa, Ohinemuri County—II, 72.
Omahu Creek, Omahu district, Thames County—I, 15, 58, 59, 63, 100, 229, 231, 235, 236; II, 57, 73, 74.
Omahu district, Thames County—I, 15, 32, 60-64, 66, 98, 100, 228-36.
Omahu Peak, Omahu district, Thames County—I, 56, 59-64, 66, 98, 99, 101, 111, 228, 229, 231-36; II, 13, 55-58, 73, 75, 127.
Otago—I, 36; II, 167.
Otoheo, Coromandel-Manaia district, Coromandel County—I, 57; II, 144.
Otonui, Thames district, Thames County—I, 97.
Opitonui, Coromandel County—I, 45, 49, 55, 85.
Opitonui Creek, Opitonui district, Coromandel County—I, 47, 80, 205.
Opitonui district, Coromandel County—I, 47, 80, 82, 205-8.
Opotiki—I, 29.
Owharoa, Ohinemuri County—I, 50, 53, 54, 57, 63, 107-10; II, 2, 3, 5, 15, 23, 24, 26, 30, 33, 34, 46, 65, 66, 69, 70-72, 137, 138.
Owharoa district, Ohinemuri County—I, 52, 53, 60, 106, 107, 125, 126.
Pa Hill, Kapanga district, Coromandel County—I, 135.
Paeroa, Ohinemuri County—I, 102, 103; II, 8, 10, 12, 32.
Paeroa district, Ohinemuri County—I, 55.
Paku Island, Coromandel County—I, 59, 61-63, 89, 256-66, 271-72, 282; II, 118.
Palliser Bay, Wellington—II, 151, 178-85.
Pannikin Hill, Mercury Bay district, Coromandel County—I, 63, 86; II, 127.
Papahua Mountains, Nelson—II, 159.
Paparoa, Cabbage Bay district, Coromandel County—I, 50.
Paparoa Mountains, Nelson—II, 159.
Paul's Creek, Kapanga district, Coromandel County—I, 35, 76, 134.
Peak East of Una Hill, Thames district, Thames County—II, 100.
Pevril Mine, Tiki-Tokatea district, Coromandel County—I, 183, 186.
Piako County—I, 29, 249, 250, 253.
Port Charles, Moehau district, Coromandel County—I, 26, 31, 50, 54, 67, 68, 70.
Port Jackson, Moehau district, Coromandel County—I, 26, 31, 39, 50, 67.
Poverty Bay, Auckland—II, 151, 174-78.
Preece's Point, Kapanga district, Coromandel County—I, 51, 72, 134.
Preservation Inlet, Otago—II, 150, 167.
Pukewhau, Tiki-Tokatea district, Coromandel County—I, 137.
Pukewhau Branch (of Tiki Creek), Tiki-Tokatea district, Coromandel County—I, 151, 152.
Pukewhau Creek, Tiki-Tokatea district, Coromandel County—I, 38, 41, 80, 153.
Pukewhau Junction, Tiki-Tokatea district, Coromandel County—I, 137.
Pukewhau Saddle, Tiki-Tokatea district, Coromandel County—I, 35, 41, 42, 76, 79, 80, 151.
Punga Flat, Thames district, Thames County—II, 107.
Puriri Thames County—I, 66, 99.

Puriri River, Stream, and Valley, Thames County—I, 29, 58, 59, 61, 62, 91, 98; II, 122, 123.
Puru Stream, Thames district, Thames County—I, 30, 55.
Quarries, Hape Creek, Thames district, Thames County—II, 87.
Quarries, Tararipo Creek, Paeora, &c., district, Ohinemuri County—II, 8.
Quarries, Waihi-Silverton Battery, Waihi district, Ohinemuri County—II, 139.
Quarries, western base of Omahu Peak, Omahu district, Thames County—II, 127.
Radical Mine, Owharoa district, Ohinemuri County—II, 69, 72.
Rahu Saddle, Paeroa, &c., district, Ohinemuri County—I, 33, 55, 102–4; II, 9, 23, 137.
Rangihau district, Thames County—I, 88.
Rangihau River, Gumtown-Rangihau district, Thames County—I, 60, 65, 212, 221.
Rangihau Valley, Gumtown-Rangihau district, Thames County—I, 5, 9, 60, 61, 63, 64, 66, 86, 111, 112, 213–16, 218–20, 222–27; II, 113, 118, 126, 128.
Raukekoro River, Cook County, Auckland—II, 11.
Ravenswood Claim and Mine, Karangahake district, Ohinemuri County—I, 46, 49; II, 9, 23, 27.
Red Hill, east coast of Wellington—II, 149, 150, 155–57.
Rimutaka, Wellington—I, 37.
Rocky Point, Teremakau Valley, Westland—II, 151, 186, 196, 199.
Rocky Point, Thames district, Thames County—I, 30, 40, 58, 76, 93, 138, 179; II, 42, 80, 88.
Royal Oak Mine, Tiki-Tokatea district, Coromandel County—I, 35, 38, 75, 186, 191.
Ruapehu Claim, Owharoa district, Ohinemuri County—I, 53, 54; II, 2, 4, 72, 138.
Saddle east side of Omahu Peak, Omahu district, Thames County—II, 57.
Scotty's Hill and Mine, Kapanga district, Coromandel County—I, 52, 53, 72, 76, 154, 156, 158–60.
Second Gorge of Arahura River, Westland—II, 195, 199.
Shellback Creek, Thames district, Thames County—I, 46, 47, 93; II, 106–8.
Sheridan Mine, Tapu Creek, Thames County—I, 247.
Shortland Flat, Thames district, Thames County—I, 93, 94.
Silverton Hills, Waihi district, Ohinemuri County—I, 33, 66, 110, 111; II, 14, 16, 18, 28, 30, 54, 72.
Slip Creek, Gumtown-Rangihau district, Thames County—I, 60–64, 211–16, 218–20, 222, 225–27; II, 118, 128.
Slip Hill, Gumtown-Rangihau district, Thames County—I, 61, 62.
South Island—I, 34, 68; II, 170.
Southern Alps—I, 34.
Southland—I, 36.
Stony Creek, Gumtown-Rangihau district, Thames County—I, 58, 59, 215, 217, 218.
Success Claim and Mine, Tiki-Tokatea district, Coromandel County—I, 144, 183, 189.
Success Range, Tiki-Tokatea district, Coromandel County—I, 37, 44, 48, 49, 72, 162.
Success Spur, Tiki-Tokatea district, Coromandel County—I, 77.
Sugar Loaves, Taranaki—II, 150, 161, 162.
Sylvia Battery, Thames district, Thames County—II, 90.
Table Mountain, Thames County—I, 30, 32, 55, 58, 60, 61, 64, 66, 86, 95, 97, 212, 214, 215, 222, 228; II, 105, 113, 115, 120, 124–26.
Taipo River, Teremakau Valley, Westland—II, 153, 186, 199.
Tairua River, Thames County—I, 29, 30, 32, 50, 58–60, 85, 86, 89–91, 96, 97, 101, 102, 244, 256–61, 263–66, 271–78, 280–82; II, 28, 73, 103, 114, 121, 146, 147.
Tairua-Wharekawa district, Thames County—I, 61–63.
Tairua watershed, Thames County—I, 60, 99, 108.
Takatimu Mountains, Southland—I, 36.
Talisman Extended Claim, Karangahake district, Ohinemuri County—I, 49; II, 36, 45, 46.
Tapu Creek, Thames County—I, 2, 26, 27, 31, 39, 40, 44, 45, 47–49, 92, 93, 179, 240.
Tapu Creek Gorge, Thames County—I, 254.
Taranaki—II, 161, 162.
Tararipi Creek, Paeroa, &c., district, Ohinemuri County—I, 56; II, 8.
Tararu Beach, Thames district, Thames County—II, 80.
Tararu Creek, Thames district, Thames County—I, 1, 46–49, 93, 94; II, 39, 42, 80, 81, 88–94, 106, 108, 110, 111.
Tararu Valley, Thames district, Thames County—I, 228.
Tauranga County—I, 59, 114.
Tauranga Harbour and Inlet—I, 29, 109, 114.
Tawhitarangi, Cabbage Bay district, Coromandel County—I, 8, 41, 43, 175.
Te Aroha, Piako County—I, 2, 29, 45–48, 55, 59, 114, 249, 250, 253; II, 10, 12, 31, 140.
Te Aroha district, Piako County—I, 114, 115, 251–53.
Te Kouma Hills, Beeson's Island, &c., district, Coromandel County—I, 74.
Te Mata, Thames County—I, 92.
Teremakau Valley, Westland—II, 151–53, 186, 193, 196, 199.
Te Tuku, Matarangi district, Coromandel County—I, 204.
Thames—I, 1, 2, 4, 8, 9, 27, 30, 40, 47, 58, 76, 80, 92–94, 99, 138, 223, 279.
Thames County—I, 50, 56, 57, 179, 222, 237–40, 249, 254, 267–70.
Thames district, Thames County—I, 45, 46, 48, 49, 94, 96; II, 39, 42, 73, 76, 77, 79–82, 84–87, 89, 90, 93–96, 98, 100, 106.
Thames Goldfields—I, 2, 3, 5, 7–9, 26–28, 92, 94; II, 44, 77, 78, 80, 86, 91–93, 97.
Thames River and Valley—I, 27, 29, 30, 55, 91, 98-109, 228; II, 8.
The Booms, Kauaeranga district, Thames County—I, 57; II, 106.
The Dove, Mandamus Valley, Amuri district, Nelson—II, 160, 161.
The Kilns, Waitekauri district, Ohinemuri County—II, 20, 21.

The Steps, Hikutaia district, Thames County—I, 15, 245.
The Wires, Tairua-Wharekawa district, Thames County—I, 15, 60, 62, 64, 91, 101, 102, 243–45; II, 28, 101, 103.
Tiki, Coromandel County—I, 31, 36, 44, 45, 69, 72, 80, 138, 139, 162.
Tiki Creek, Tiki-Tokatea district, Coromandel County—I, 38, 39, 79, 80, 131, 137–39, 151–53, 194.
Tiki Saddle, Tiki-Tokatea district, Coromandel County—I, 76, 82.
Tiki Spur, Tiki-Tokatea district, Coromandel County—I, 35, 75, 136.
Tiki-Mercury Bay Road, Waiau, &c., district, Coromandel County—I, 135, 150.
Tiki-Tokatea district, Coromandel County—I, 34, 37–39, 44, 48, 49, 57, 64, 65, 70, 72, 78–80, 132, 135–39, 143, 144, 151–53, 161, 162, 175, 176, 178–81, 183–85, 189, 191, 194.
Tinkers Creek and Gully, Thames district, Thames County—I, 93, 94; II, 88, 89, 91, 92, 94, 106–8, 143.
Tokatea, Coromandel County—I, 70.
Tokatea Big Reef, Tiki-Tokatea district, Coromandel County—I, 77.
Tokatea Claim, Tiki-Tokatea district, Coromandel County—I, 180.
Tokatea Goldfield, Coromandel County—I, 181.
Tokatea Hill, Tiki-Tokatea district, Coromandel County—I, 2, 31, 32, 35–37, 44, 55, 69, 75–77, 136, 138, 139, 155, 158, 160–62, 177, 183–85, 191, 192, 206; II, 140, 141, 144.
Tokatea Mine, Tiki-Tokatea district, Coromandel County—I, 35, 38, 136, 175, 176, 178, 183, 185.
Tokatea Range, Tiki-Tokatea district, Coromandel County—I, 31, 43, 44, 70, 72, 173, 178, 179.
Tokatea Saddle, Tiki-Tokatea district, Coromandel County—I, 39, 44, 50, 75, 76, 138, 155, 158, 177, 178, 180, 182, 184–86.
Torehine (or Torihine), Cabbage Bay district, Coromandel County—I, 43, 65, 68, 70, 71.
Trig Hill, Kapanga district, Coromandel County—I, 142.
Triumph Mine, Kapanga district, Coromandel County—I, 72, 75, 76.
Turiwhate Mountain, Teremakau Valley, Westland—II, 152.
Umangawha River and Valley, Cabbage Bay district, Coromandel County—I, 54, 56, 70, 71, 173.
Una Hill, Thames district, Thames County—I, 45–49; II, 76–79, 82, 84, 89, 93, 95–100.
Uncle's Farm (Tiki), Kapanga district, Coromandel County—I, 51.
Union Beach Mine, Kapanga district, Coromandel County—I, 53, 147.
Upper Hikutaia Valley, Ohinemuri County—II, 133, 135, 136.
Upper Ohinemuri Plain, Ohinemuri County—I, 29, 32, 59, 60.
Upper Rangihau district and Valley, Gumtown-Rangihau district, Coromandel County—I, 210, 221.
Upper Tairua Valley, Tairua-Wharekawa district, Thames County—I, 243, 245; II, 28.
Victoria Battery, Owharoa district, Ohinemuri County—I, 54; II, 5, 66, 68.
Wade, Auckland—II, 150.
Waihininini River, Arahura Valley, Westland—II, 187.
Waiaro, Coromandel County—I, 167.
Waiaro Creek, Moehau district, Coromandel County—I, 14, 40, 41, 67–69, 167–72, 174.
Waiau, Coromandel County—I, 79.
Waiau Creek, Tauranga County—II, 134.
Waiau district, Coromandel County—I, 36, 70, 187, 188; II, 143.
Waiau River, Waiau, &c., district, Coromandel County—I, 14, 39, 41, 80.
Waiau Valley, Waiau, &c., district, Coromandel County—I, 31, 41, 50, 52, 79–81, 88, 127, 135, 150.
Waiau watershed, Waiau, &c., district, Coromandel County—I, 80.
Waiau-ua Gorge, Amuri district, Nelson—II, 160.
Waihi, Ohinemuri County—I, 2, 33, 45, 50, 51, 63, 111, 113, 114; II, 15, 16, 18, 28, 30, 35, 41, 44, 47, 51, 52, 54, 59, 60, 63, 67, 68, 72, 139.
Waihi Beach and Claim, Waihi district, Ohinemuri County—I, 30, 58, 59, 62, 109, 110; II, 35, 112, 129, 130.
Waihi Consolidated Mine, Waihi district, Ohinemuri County—I, 52; II, 16.
Waihi Consols Mine, Waihi district, Ohinemuri County—I, 51; II, 51, 52, 59, 62, 64.
Waihi district, Ohinemuri County—I, 51–55, 60, 62–64, 107, 109; II, 14–19, 30, 31, 35, 60–64.
Waihi Mine, Waihi district, Ohinemuri County—I, 3, 54, 60, 111; II, 18, 28, 63, 67, 68, 139.
Waihi Monument, Waihi district, Ohinemuri County—I, 63, 110.
Waihi Plain, Waihi district, Ohinemuri County—I, 30, 32, 56, 59, 106, 108, 109, 113, 114.
Waihi-Silverton Battery, Waihi district, Ohinemuri County—II, 47, 139.
Waihi-Silverton Hills, Waihi district, Ohinemuri County—II, 18.
Waihi-Silverton Mine, Waihi district, Ohinemuri County—I, 52, 54; II, 17, 54.
Waihi South Mine, Waihi district, Ohinemuri County—I, 51; II, 51, 61, 64.
Waihi Township, Ohinemuri County—II, 63.
Waihi Union Mine, Waihi district, Ohinemuri County—I, 53, 54; II, 17–19, 63.
Waihi West Mine, Waihi, Ohinemuri County—I, 54; II, 61, 64.
Waihoanga Creek, Thames district, Thames County—I, 93.
Waihou River—I, 29, 98, 109.
Waikino, Owharoa district, Ohinemuri County—I, 54, 60, 63, 64, 106; II, 6, 15, 16, 28, 41–43, 46, 47, 53, 65, 66, 72.
Waikoromiko, Tiki-Tokatea district, Coromandel County—I, 181.
Waiomo, Thames district, Thames County—I, 49, 237, 239.
Waiomo district, Thames County—I, 92.
Waiomo Valley, Thames County—I, 92.
Waiorongomai, Te Aroha district, Piako County—I, 46–48, 114, 149, 252, 253; II, 140.
Waiotahi Creek, Thames district, Thames County—I, 93.

Waipaoa River, Poverty Bay, Auckland—II, 151, 174–77.
Waipara River, Canterbury—II, 150, 161.
Waipatakahu, Thames County—I, 31.
Wairoa Gorge, Nelson—I, 39.
Waitaia Range, Kuaotunu district, Coromandel County—I, 31, 33, 39, 83, 84, 203.
Waitawheta Gorge and River, Karangahake district, Ohinemuri County—I, 104, 106, 110, 113; II, 3, 8, 16, 31, 45, 72, 137, 138.
Waitekauri, Ohinemuri County—I, 2, 45, 50, 102.
Waitekauri Battery, Waitekauri district, Ohinemuri County—II, 20, 21.
Waitekauri Cross Mine, Waitekauri district, Ohinemuri County—I, 51, 52, 108; II, 29, 50, 51.
Waitekauri district and Valley, Ohinemuri County—I, 51, 52, 62, 64; II, 2, 6, 20–22, 28, 29, 42, 43, 50–52, 58, 59, 72.
Waitekauri Kilns, Waitekauri district, Ohinemuri County—I, 52, 55, 109, 206.
Waitekauri Stream, Ohinemuri County—I, 50, 60, 106, 107–10.
Waitekauri Township, Ohinemuri County—II, 20, 29, 51, 52, 132.
Waitekauri - Waikino Water - race, Ohinemuri County—II, 6, 43.
Waitoa Plain, Piako County—I, 55; II, 32.
Waiwawa Creek, Kauaeranga district, Thames County—II, 105, 122, 125.
Waiwawa River, Thames County—I, 55, 65, 96, 237; II, 93, 105, 113, 124, 126.
Wakanae, Cabbage Bay district, Coromandel County—I, 70.
Waterfall Creek, Owharoa district, Ohinemuri County—I, 60, 63; II, 46.
Water-race between branches of Karaka Creek, Thames district, Thames County—II, 81.
Welcome Find Claim, Kapanga district, Coromandel County—I, 52, 129.
Welcome Jack Mine, Gumtown-Rangihau district, Thames County—I, 60, 222, 223.
Wellington—I, 37, 81; II, 150, 154–57, 163–66, 178–85.
West coast of Wellington—II, 160.
Westland—II, 186–99.
Westport, Nelson—II, 150.
Whangamata, Tairua-Wharekawa district, Thames County—I, 15, 64, 66, 91, 228, 235; II, 28, 30, 44, 74, 75, 95.
Whangapoua, Opitonui district, Coromandel County—I, 54, 75, 82.
Wharekawa, Tairua-Wharekawa district, Thames County—I, 50, 90.
Wharekawa Inlet and River, Tairua-Wharekawa district, Thames County—I, 58–60, 108.
Wharekiraupunga, Ohinemuri County—I, 51; II, 98.
Wharekuri River, Opitonui district, Coromandel County—I, 208.
Whenuakite River and Valley, Mercury Bay district, Coromandel County—I, 50, 85, 86.
Whitianga River and district, Coromandel County—I, 38, 50, 59, 85–87; II, 127.
Woodstock Main Lode, Karangahake district, Ohinemuri County—II, 7, 27.
Woodstock Mine, Karangahake district, Ohinemuri County—I, 46, 47, 49; II, 23, 39, 40, 45, 49.

By Authority: John Mackay, Government Printer, Wellington.—1906.